

# Product Information

**ISSUE DATA : 2007-12-20**

**MODEL : LMS700KF07**

**Note : The Product and specifications are subject to change without any notice.  
Please ask for the latest Product Standards to guarantee the satisfaction of  
your product requirements.**

**PREPARED BY : AM LCD Mobile Display Development**

**Samsung Electronics Co. , LTD.**

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## Revision History

Preliminary

| Data          | Rev.<br>No. | Page | Summary                                                                                                     |
|---------------|-------------|------|-------------------------------------------------------------------------------------------------------------|
| Dec. 05. 2007 | 000         |      | <b>Rev.000 is first issued.</b>                                                                             |
| Dec. 20. 2007 | 001         |      | <b>Rev.001 is issued.</b><br><b>9. Outline Dimension</b> is corrected<br>- Hatching Area on FPC is removed. |



## General Description

### \* Description

LMS700KF07 is a TMR(Transmissive with Micro Reflective) type color active matrix TFT (Thin Film Transistor) liquid crystal display (LCD) that uses amorphous silicon TFT as a switching devices. This model is composed of a TFT-LCD module, a driver circuit and a back-light unit. The resolution of a 7.0" contains 800 x 480(RGB) dots and can display up to 16.7M colors.

### \* Features

- Triple-Gate Technology applied
- Transmissive with Micro Reflective type and Back-light with LED is available.
- TN (Twisted Nematic) mode
- 24bit RGB Interface
- Back Light with 24 LEDs (Light Emitting Diode)

### \* Applications

- Display terminals for PMP(Portable Multimedia Player) , Portable CNS(P-CNS) , AV , UMPC (Ultra Mobile PC) application products.



## \* General information

| Items             | Specification                | Unit    | Note   |
|-------------------|------------------------------|---------|--------|
| Display area      | 152.4(H) x 91.44(V)          | mm      | -      |
| Driver element    | a-Si TFT active matrix       | -       | -      |
| Display colors    | 16.7M                        | colors  | -      |
| Number of pixels  | 800(H) x 480 x RGB(V)        | dot     | -      |
| Pixel arrangement | RGB stripe type (Horizontal) | -       | -      |
| Pixel pitch       | 0.1905(H) x 0.1905(V)        | mm      | -      |
| Display mode      | Normally white               | -       | -      |
| Viewing direction | 6                            | o'clock | Note 1 |

Note 1. Gray inversion at the viewing direction

## \* Mechanical information

| Item        |               | Min.  | Typ.  | Max.  | Unit | Note   |
|-------------|---------------|-------|-------|-------|------|--------|
| Module size | Horizontal(H) | 162.9 | 163.2 | 163.5 | mm   | -      |
|             | Vertical(V)   | 103.7 | 104.0 | 104.3 | mm   | Note 2 |
|             | Depth(D)      | 4.3   | 4.5   | 4.7   | mm   | Note 2 |
| Weight      |               | -     | 139.0 | -     | g    | -      |

Note 2. Not include FPC

Refer to the Outline Dimension in the "9.Outline Dimension" for further information.

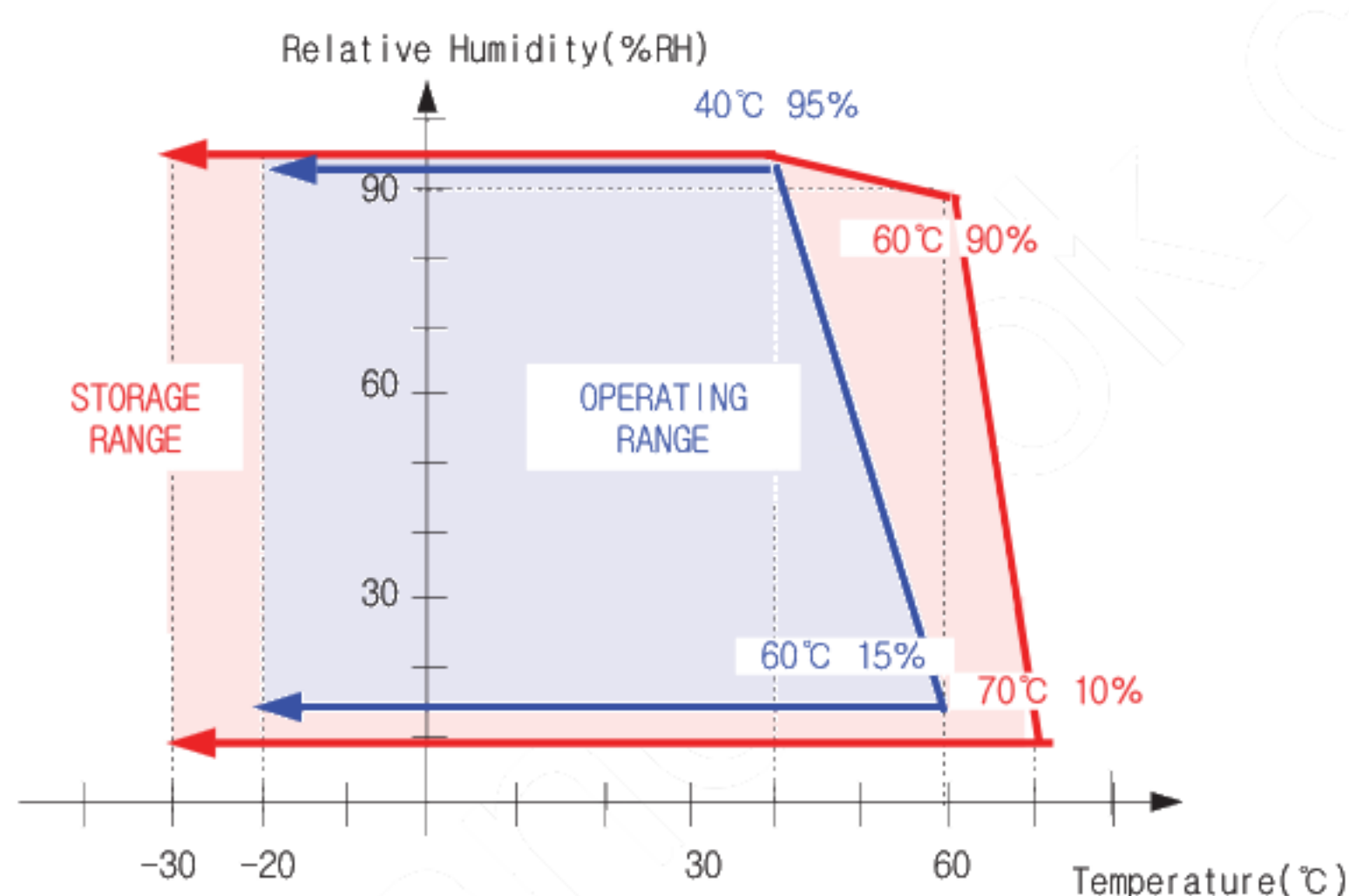
## 1. Absolute Maximum Ratings

### 1.1 Absolute Ratings of Environment

| Item                                           | Symbol           | Min. | Max. | Unit | Note    |
|------------------------------------------------|------------------|------|------|------|---------|
| Storage temperature                            | T <sub>STG</sub> | -30  | 70   | °C   | (1)     |
| Operating temperature<br>(Ambient temperature) | T <sub>OPR</sub> | -20  | 60   | °C   | (1),(2) |

Note (1) 95 % RH Max. ( 40 °C <sup>3</sup> Ta )

Maximum wet-bulb temperature at 39 °C or less. (Ta > 40 °C) No condensation.



(2) In case of below 0°, the response time of liquid crystal (LC) becomes slower and the color of panel becomes darker than normal one.

Level of retardation depends on temperature, because of LC's characteristics.

(3) If any fixed pattern is displayed on LCD for minutes, image-sticking phenomenon may occur.

## 1.2 Electrical Absolute Ratings

### (1) TFT-LCD Module

(Ta = 25°C, V<sub>SS</sub>=GND=0V)

| Characteristics      | Symbol          | Min. | Max. | Unit | Note |
|----------------------|-----------------|------|------|------|------|
| Power supply voltage | V <sub>CC</sub> | -0.5 | 5.0  | V    | -    |

### (2) Back-Light Unit

(Ta = 25 ± 2°C)

| Item        | Symbol         | Min. | Max. | Unit. | Note |
|-------------|----------------|------|------|-------|------|
| LED Current | I <sub>L</sub> | -    | 30   | mA    | (1)  |

Note (1) Permanent damage to the device may occur if maximum values are exceeded or reverse voltage is loaded.

Functional operation should be restricted to the conditions described under normal operating conditions.



## 2. Optical Characteristics

The following items are measured under stable conditions. The optical characteristics should be measured in a dark room or equivalent state with the methods shown in Note (1).

Measuring equipment: SR-3, BM-7, EZ-Contrast

(Ta = 25 ± 2°C, V<sub>cc</sub> = 3.3V, f<sub>B</sub> = 60Hz, I<sub>B</sub> = 20mA)

| Item                                 | Symbol           | Condition | Min.  | Typ.  | Max.  | Unit              | Note               |
|--------------------------------------|------------------|-----------|-------|-------|-------|-------------------|--------------------|
| Contrast ratio<br>(Center point)     | C/R              | NOTE (1)  | -     | 400   | -     | -                 | (2)<br>SR-3        |
| Luminance of white<br>(Center point) | YL               |           | 220   | 280   | -     | cd/m <sup>2</sup> | (3)<br>SR-3        |
| Response<br>time                     | Rising:Tr        | Tr+Tf     | -     | 22    | -     | msec              | (5)<br>BM-7        |
|                                      | Falling:Tf       |           |       |       |       |                   |                    |
| Color<br>chromaticity<br>(CIE 1931)  | White            | Wx        | 0.269 | 0.319 | 0.369 | -                 | (6)<br>SR-3        |
|                                      |                  | Wy        | 0.292 | 0.342 | 0.392 |                   |                    |
|                                      | Red              | Rx        | 0.565 | 0.615 | 0.665 |                   |                    |
|                                      |                  | Ry        | 0.313 | 0.363 | 0.413 |                   |                    |
|                                      | Green            | Gx        | 0.298 | 0.348 | 0.398 |                   |                    |
|                                      |                  | Gy        | 0.515 | 0.565 | 0.615 |                   |                    |
|                                      | Blue             | Bx        | 0.098 | 0.148 | 0.198 |                   |                    |
|                                      |                  | By        | 0.059 | 0.109 | 0.159 |                   |                    |
| Viewing<br>angle                     | Hor.             | qL        | -     | 65    | -     | Degrees           | (7)<br>Ez-Contrast |
|                                      |                  | qR        | -     | 65    | -     |                   |                    |
|                                      | Ver.             | fH        | -     | 50    | -     |                   |                    |
|                                      |                  | fL        | -     | 60    | -     |                   |                    |
| Brightness Uniformity<br>(9 point)   | B <sub>uni</sub> |           | 70    | 80    | -     | -                 | (4)<br>SR-3        |
| Crosstalk                            |                  |           | -     | -     | 5     | %                 | (8)<br>SR-3        |

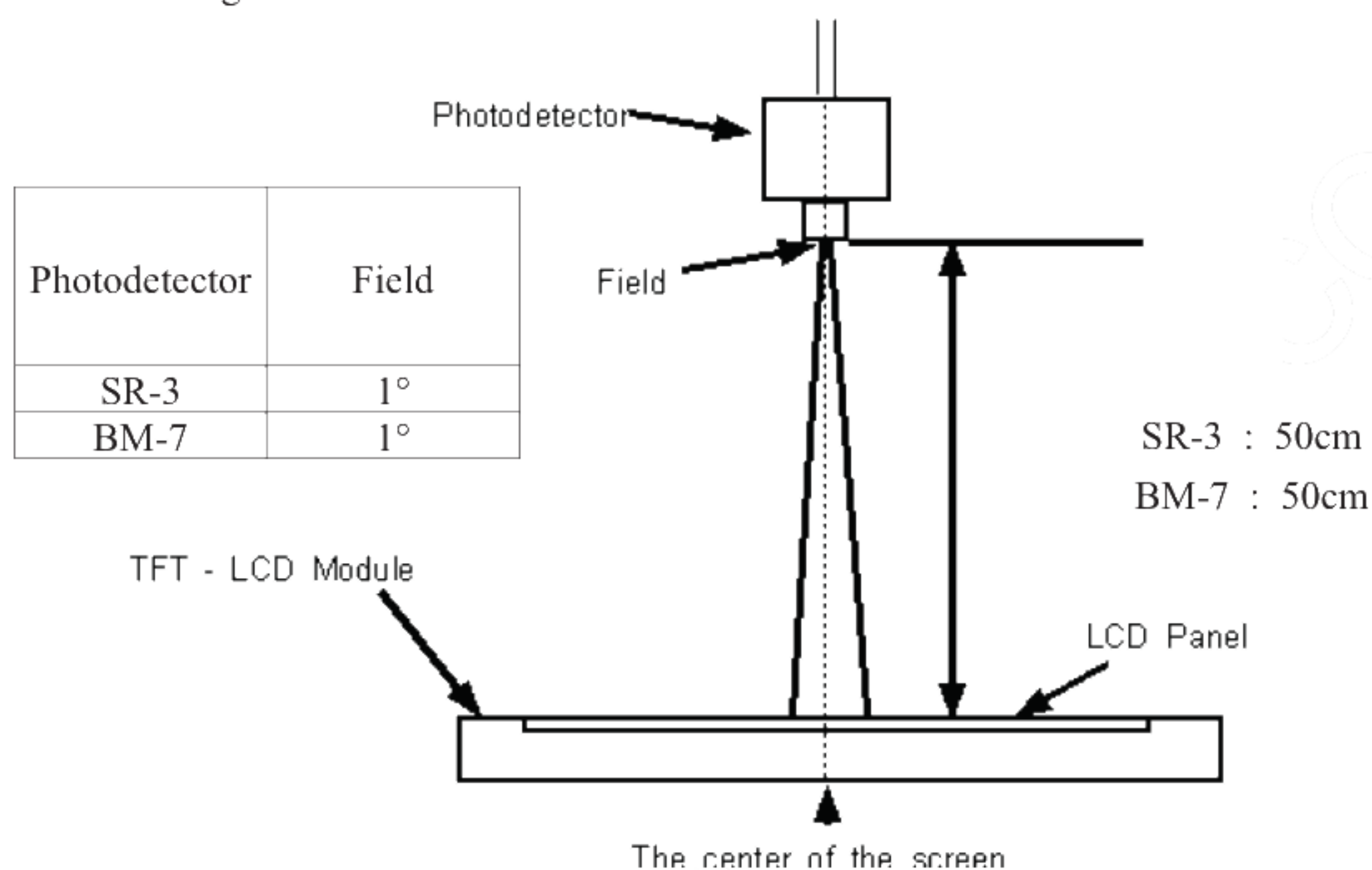


## Note (1) Test Equipment Setup

After stabilizing and leaving the panel alone at a given temperature for 30 min , the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. 30 min after lighting the back-light. This should be measured in the center of screen.

Environment condition :  $T_a = 25 \pm 2 \text{ }^{\circ}\text{C}$

Back-Light On condition



Note (2) Definition of Contrast Ratio (C/R) : Ratio of gray max (Gmax) & gray min (Gmin) at the center point

$$CR = \frac{G_{\max}}{G_{\min}}$$

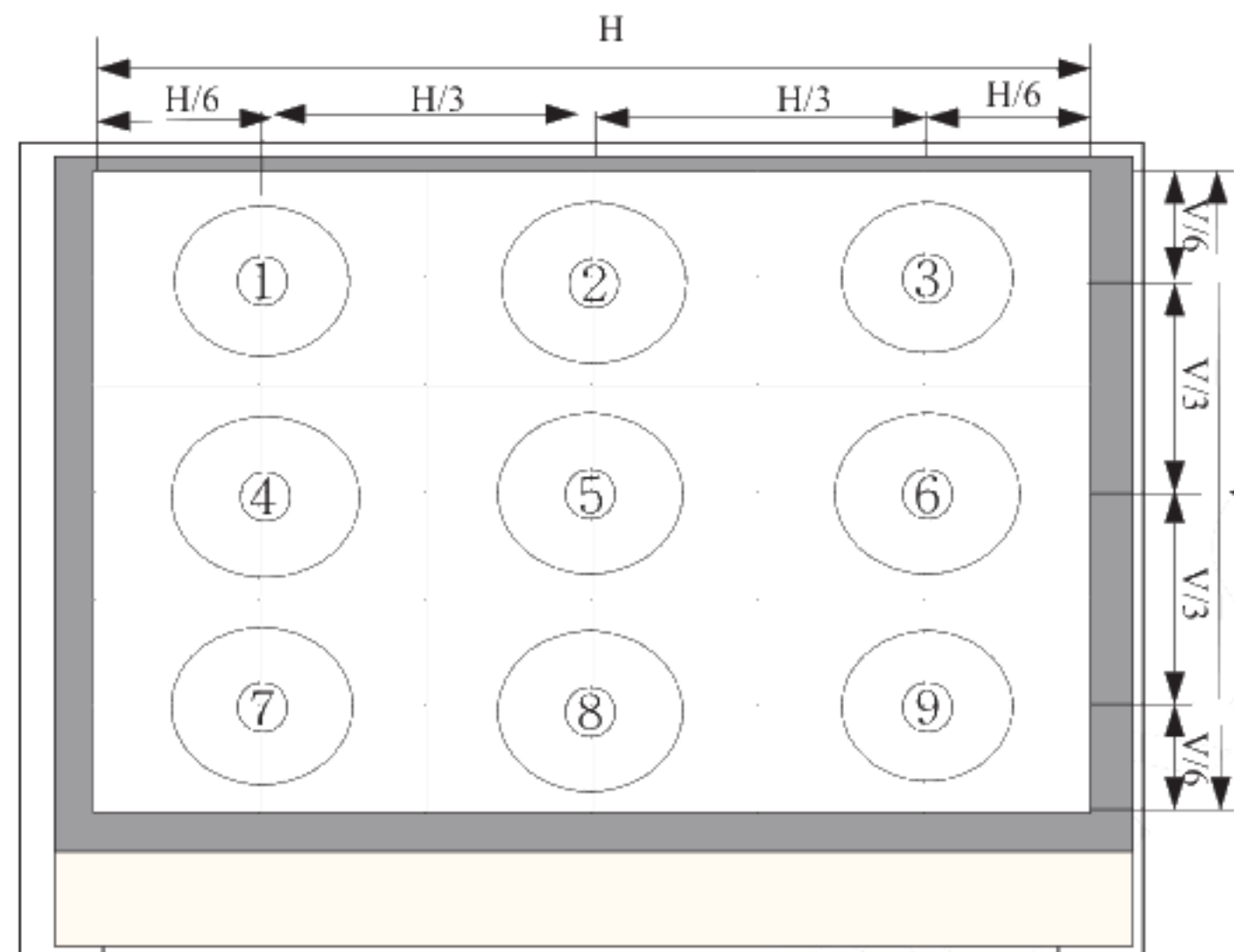
\* Gmax : Luminance with all pixels white

\* Gmin : Luminance with all pixels black

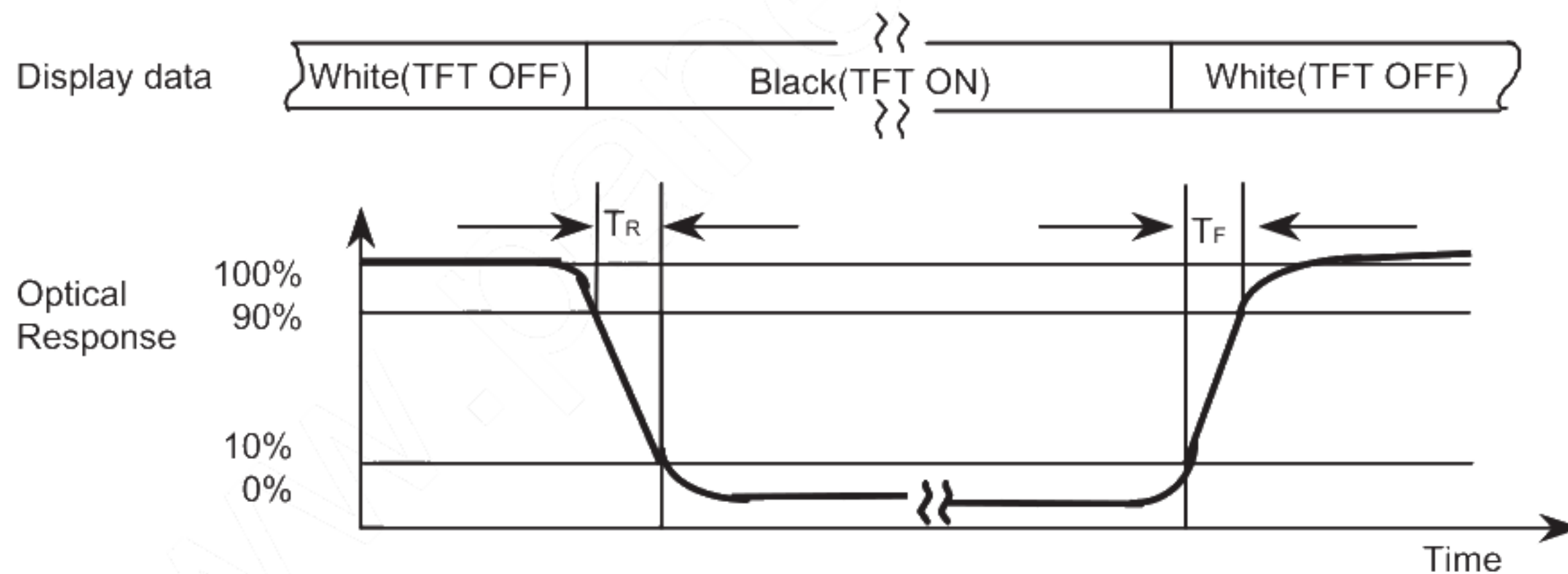
Note (3) Definition of Luminance of White : Luminance of white at the center point

Note (4) Definition of White Uniformity :

$$\text{White Uniformity} = \frac{\text{Min luminance of white among 9-points}}{\text{Max luminance of white among 9-points}} \times 100$$



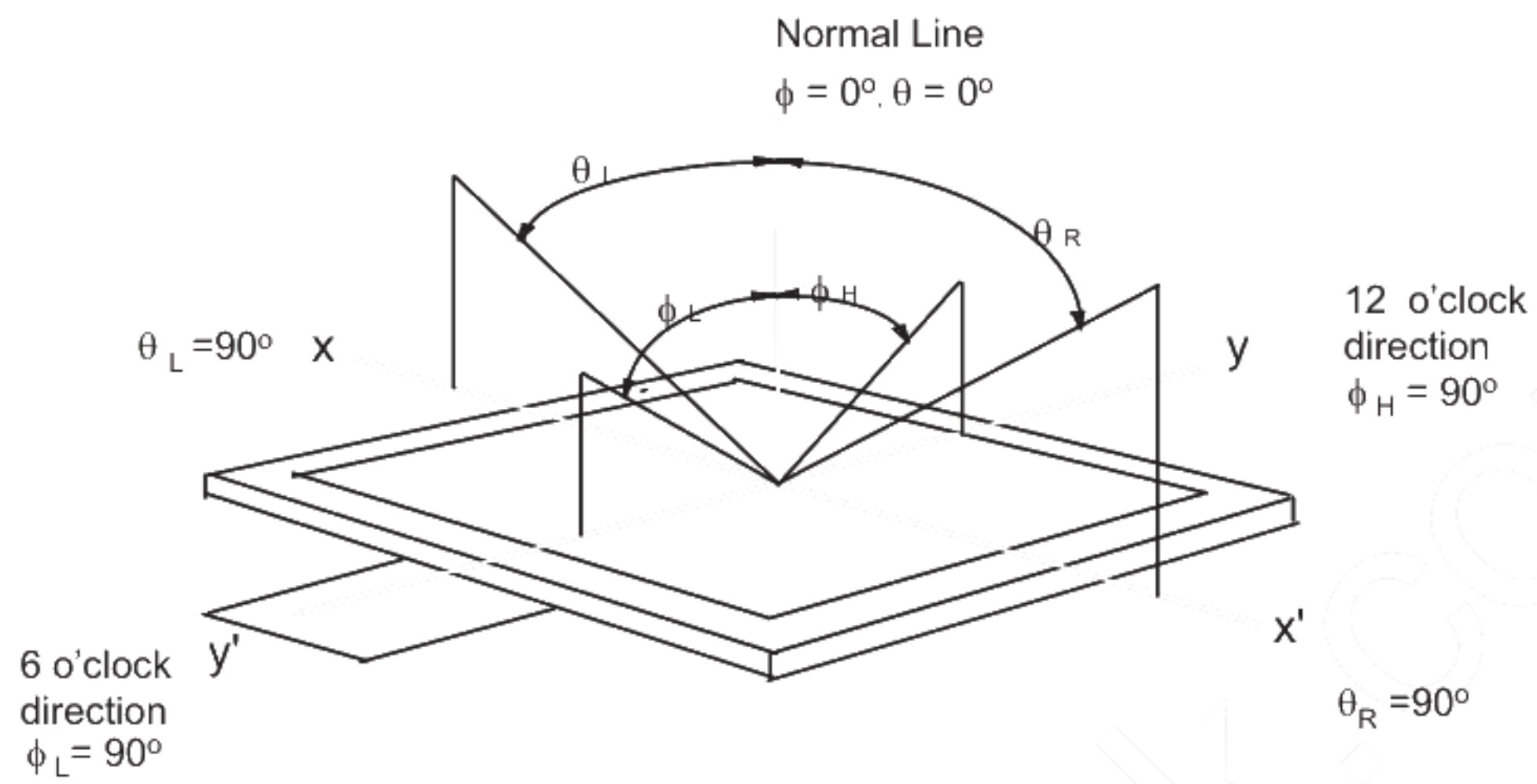
Note (5) Definition of Response time : Sum of  $T_R$ ,  $T_F$



Note (6) Definition of Color Chromaticity (CIE 1931)

Color coordinate of white & red, green, blue at center point.

Note (7) Definition of Viewing Angle : Viewing angle range ( $CR \geq 10$  )





## Note (8) Crosstalk

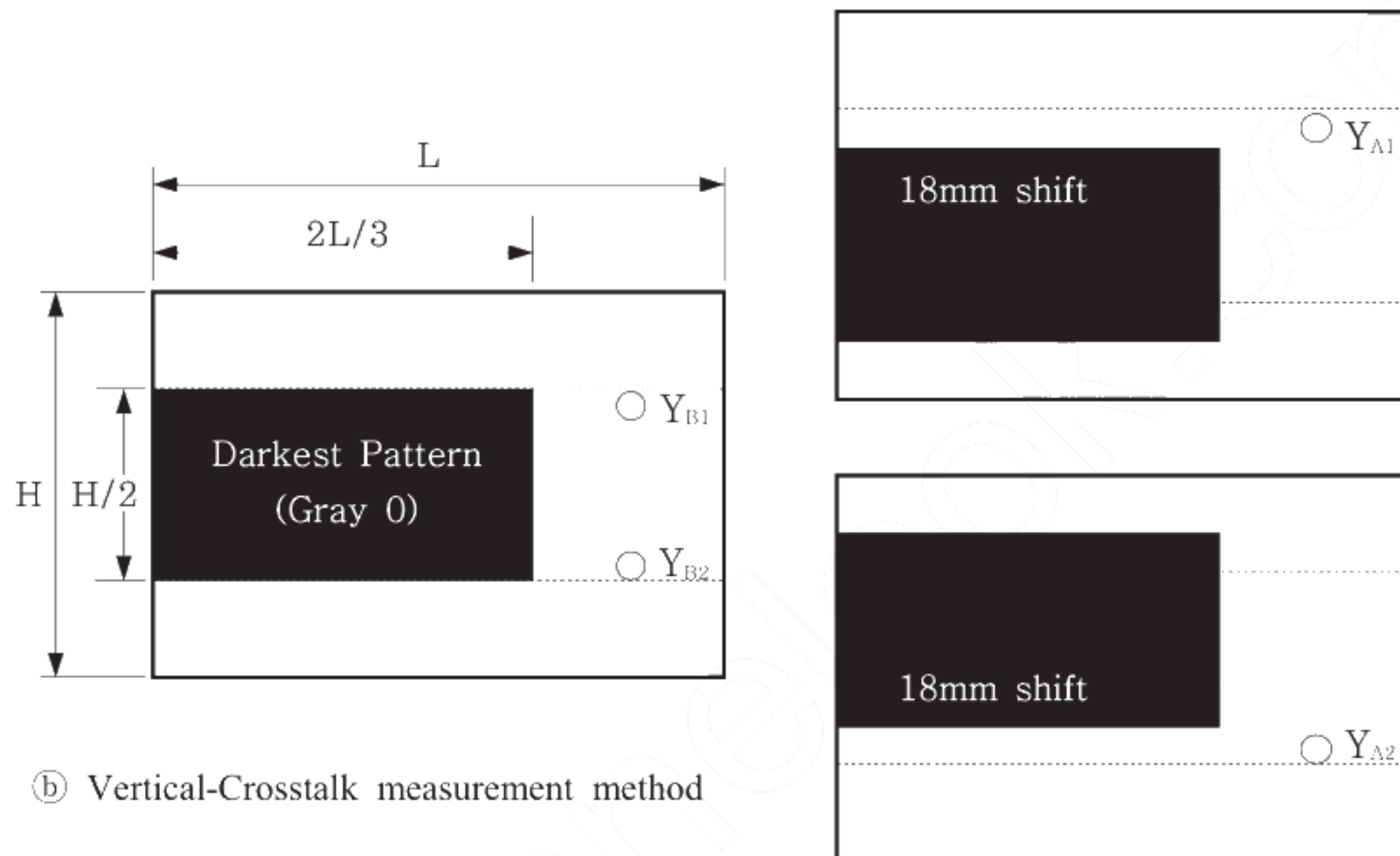
$$\text{Crosstalk Modulation Ratio}(D_{SHA}) = \frac{|Y_A - Y_B|}{Y_A} \times 100 (\%)$$

Where

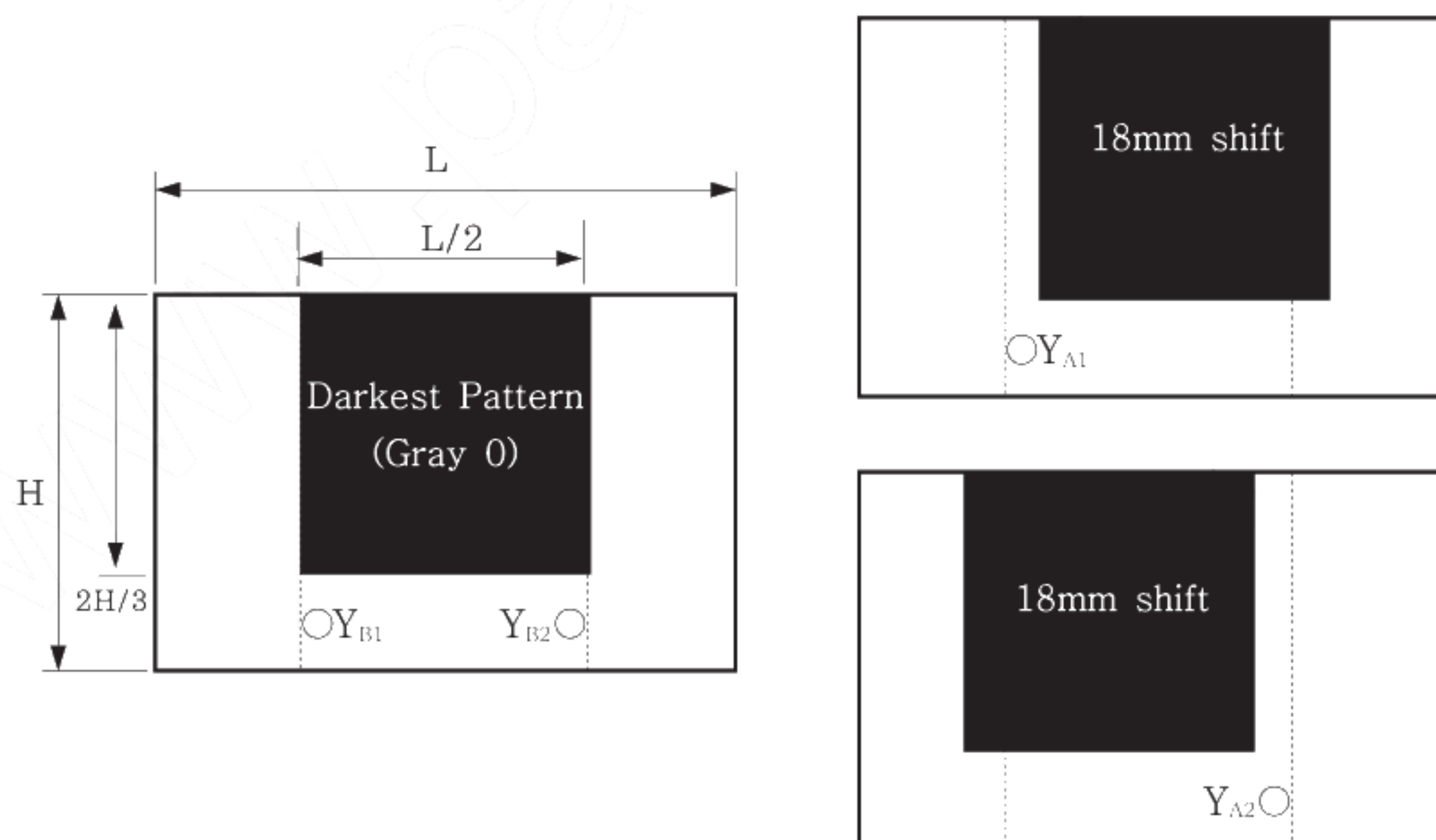
$Y_A$  ,  $Y_B$  measurement = 2° Viewing Angle (Measurement area  $\varphi 12\text{mm}$ )

The pattern except the Black Bar is a gray 127.

### ① Horizontal-Crosstalk measurement method



### ② Vertical-Crosstalk measurement method





## 3. Electrical Characteristics

### 3-1 TFT-LCD Module

$T_a = 25 \pm 2^\circ\text{C}$

| Characteristics      |       | Symbol      | Min. | Typ. | Max. | Unit | Note    |
|----------------------|-------|-------------|------|------|------|------|---------|
| Power supply voltage |       | $V_{CC}$    | 3.0  | 3.3  | 3.6  | V    | -       |
| Power Dissipation    | White | $P_{FULL}$  | -    | 300  | 390  | mW   | (1),(2) |
|                      | Black |             | -    | 300  | 390  |      |         |
|                      | 1 DOT |             | -    | 450  | 590  |      |         |
| Frame frequency      |       | $f_{Frame}$ | 56   | 60   | 65   | Hz   | -       |
| Dot Clock            |       | DOTCLK      | 22.7 | 24.5 | 26.5 | MHz  | -       |

\* To prevent a latch-up or DC operation of the LCD module, the power on/off sequence should be as the Chapter 8. Power Up/Down Sequence.

Note (1)  $V_{CC} = 3.3\text{V}$ ,  $f_{Frame} = 60\text{Hz}$ ,  $\text{DOTCLK} = 24.5\text{MHz}$

(2) Dissipation current check pattern

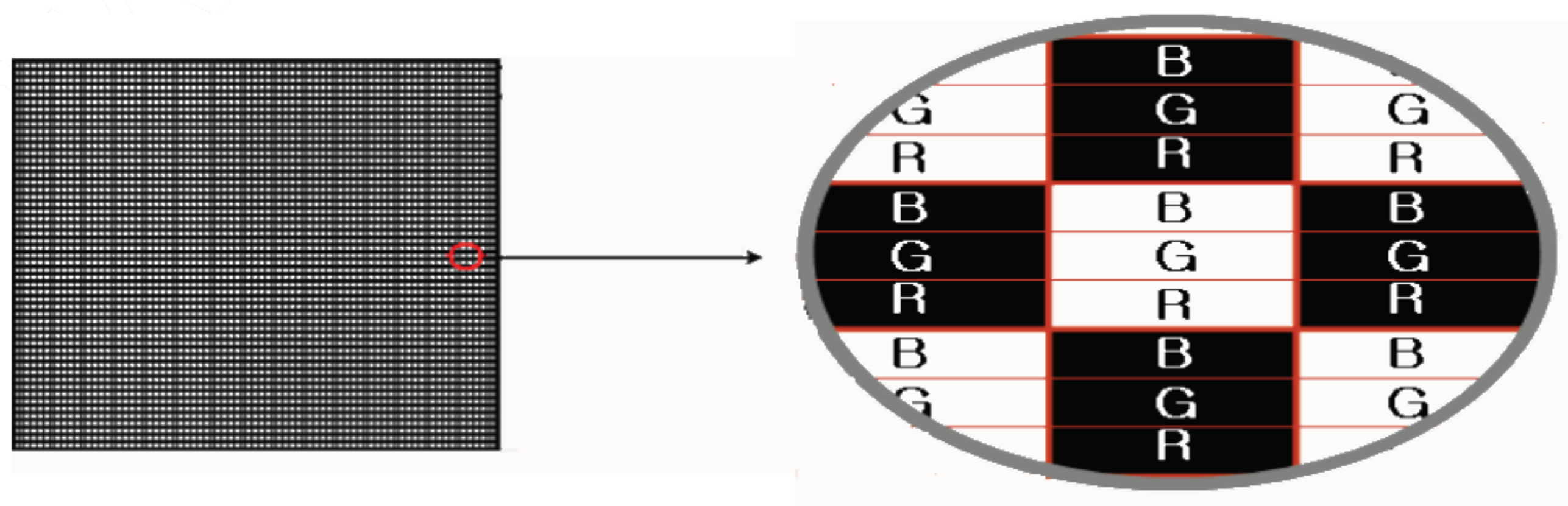
► White pattern



► Black pattern



► 1 Dot pattern



## 3-2 Back-Light unit

The Back Light system is an edge-lighting type with 24 white LED (Light Emitting Diode)s.

(Ta=25 ± 2°C)

| Item              | Symbol          | Min. | Typ. | Max. | Unit | Note |
|-------------------|-----------------|------|------|------|------|------|
| LED Current       | I <sub>B</sub>  | 15   | 20   | 25   | mA   | (1)  |
| Power Consumption | P <sub>BL</sub> | 1.2  | 1.6  | 2.0  | W    | -    |

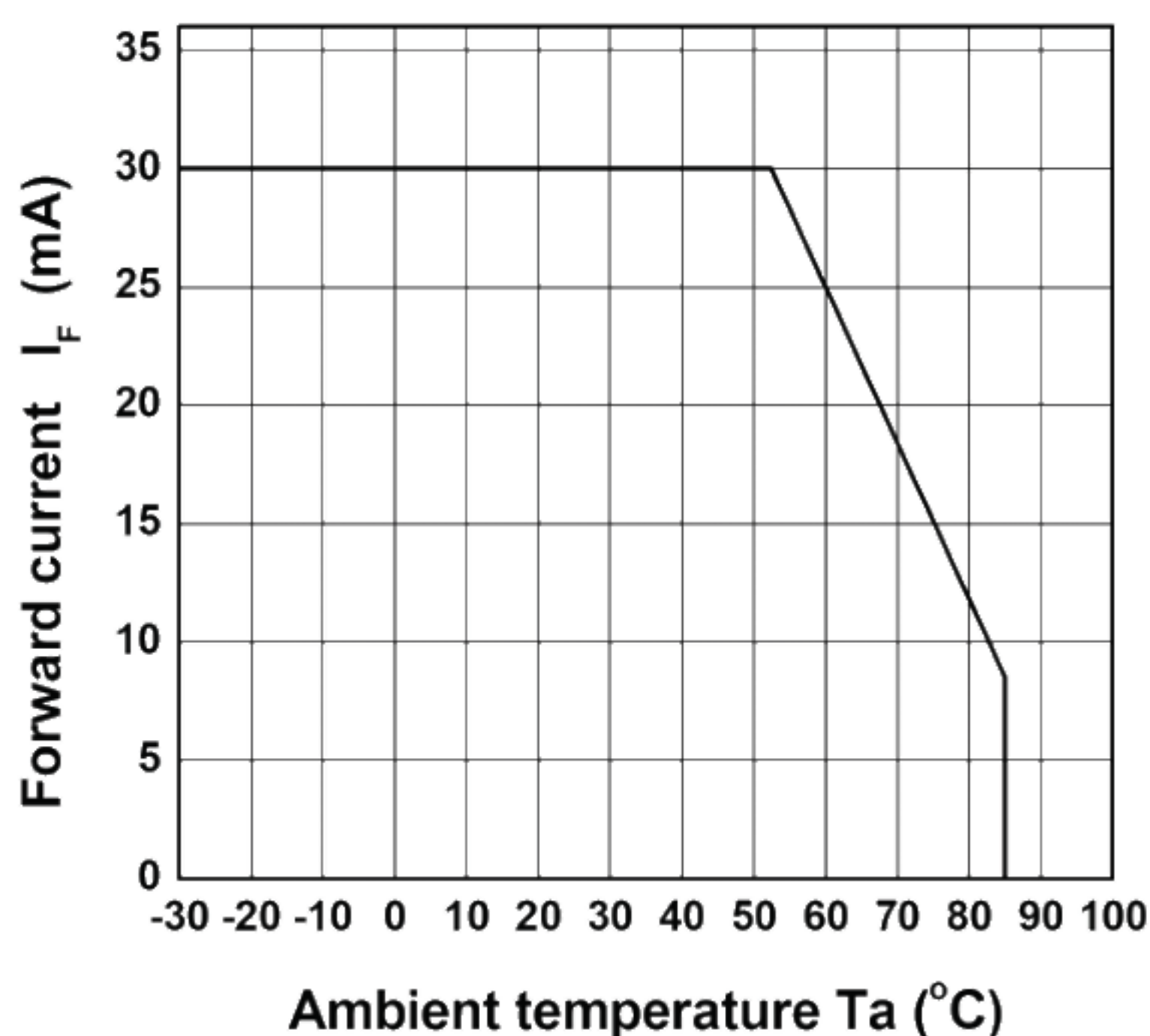
Note (1) The LEDs parallel type (Refer to 5.2)

LED current (I<sub>B</sub>) in the above table means LED current to drive one LED.

Therefore, the Power Consumption(P<sub>BL</sub>) in the above table is calculated as below,

\* If LED forward voltage is typically 3.3V,

$$P_{BL} = 3\text{string} * (3.3V * 8 \text{ Leds/string} * I_B)$$





## 4. Touch Screen Panel Specifications

### 4-1. Electrical Characteristics

| Item                  | Min. | Typ. | Max. | Unit       | Note                        |
|-----------------------|------|------|------|------------|-----------------------------|
| Linearity             | -1.5 | -    | 1.5  | %          | Analog X and Y directions   |
| Terminal resistance   | 100  | 600  | 900  | $\Omega$   | X                           |
|                       | 100  | 300  | 900  | $\Omega$   | Y                           |
| Insulation resistance | 10   | -    | -    | M $\Omega$ | DC 25V                      |
| Voltage               | 3    | 5    | 7    | V          | DC                          |
| Chattering            | -    | -    | 10   | ms         | 100k $\Omega$ pull-up       |
| Transparency          | 78   | 80   | -    | %          | JIS-K7105,ASTM D1003,@550nm |

Caution (1) : Do not operate it with a thing except a polyacetal pen(tip R0.8mm or more) or a finger, especially those with hard or sharp tips such as a ball point pen or a mechanical pencil.

### 4-2. Mechanical & Reliability Characteristics

| Item                               | Min.             | Typ. | Max. | Unit       | Note                  |
|------------------------------------|------------------|------|------|------------|-----------------------|
| Activation force                   | -                | -    | 80   | g          | (1)                   |
| Durability<br>(surface scratching) | Write<br>100,000 | -    | -    | characters | (2)                   |
| Durability<br>(surface pitting)    | 1,000,000        | -    | -    | touches    | (3)                   |
| Surface hardness                   | 3                | -    | -    | H          | JIS-K5400, ASTM D3363 |

Note (1) Stylus pen Input : R0.8mm polyacetal pen or Finger

(2) Measurement for Surface area

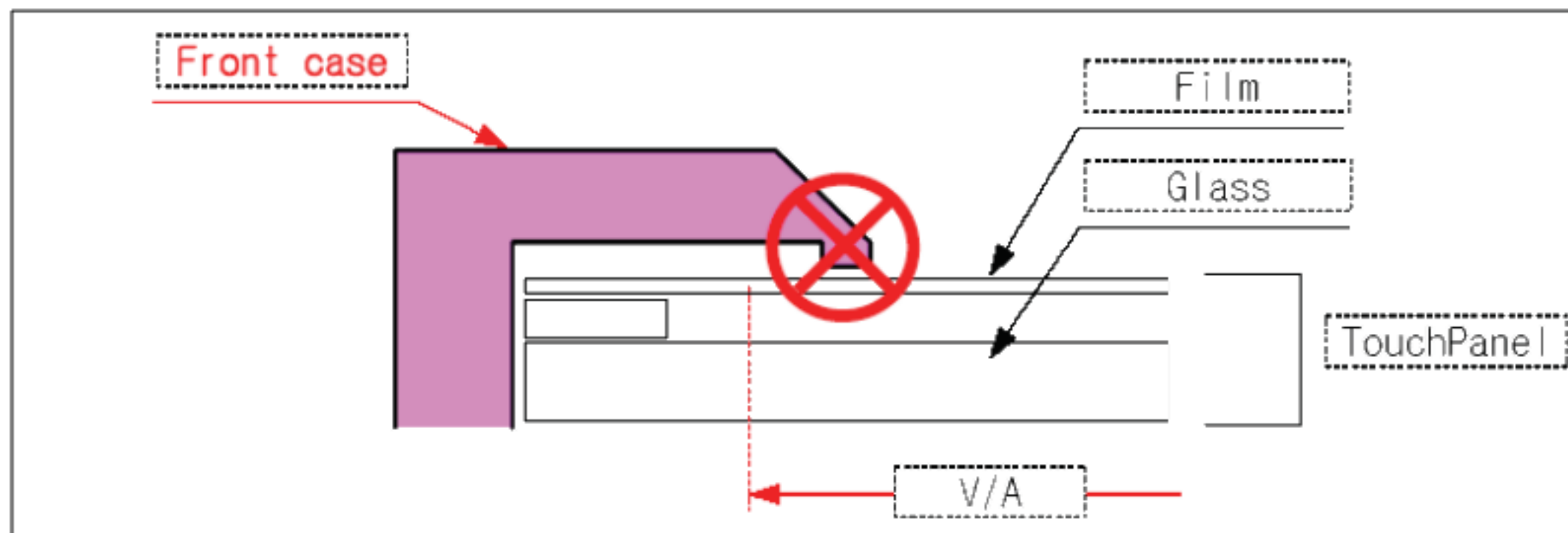
- Scratch 100,000 times straight line on the Film with a stylus change every 20,000times
- Force : 250gf
- Speed : 60mm/sec
- Stylus : R0.8 polyacetal tip

(3) Pit 1,000,000 times on the Film with a R8.0 silicon rubber.

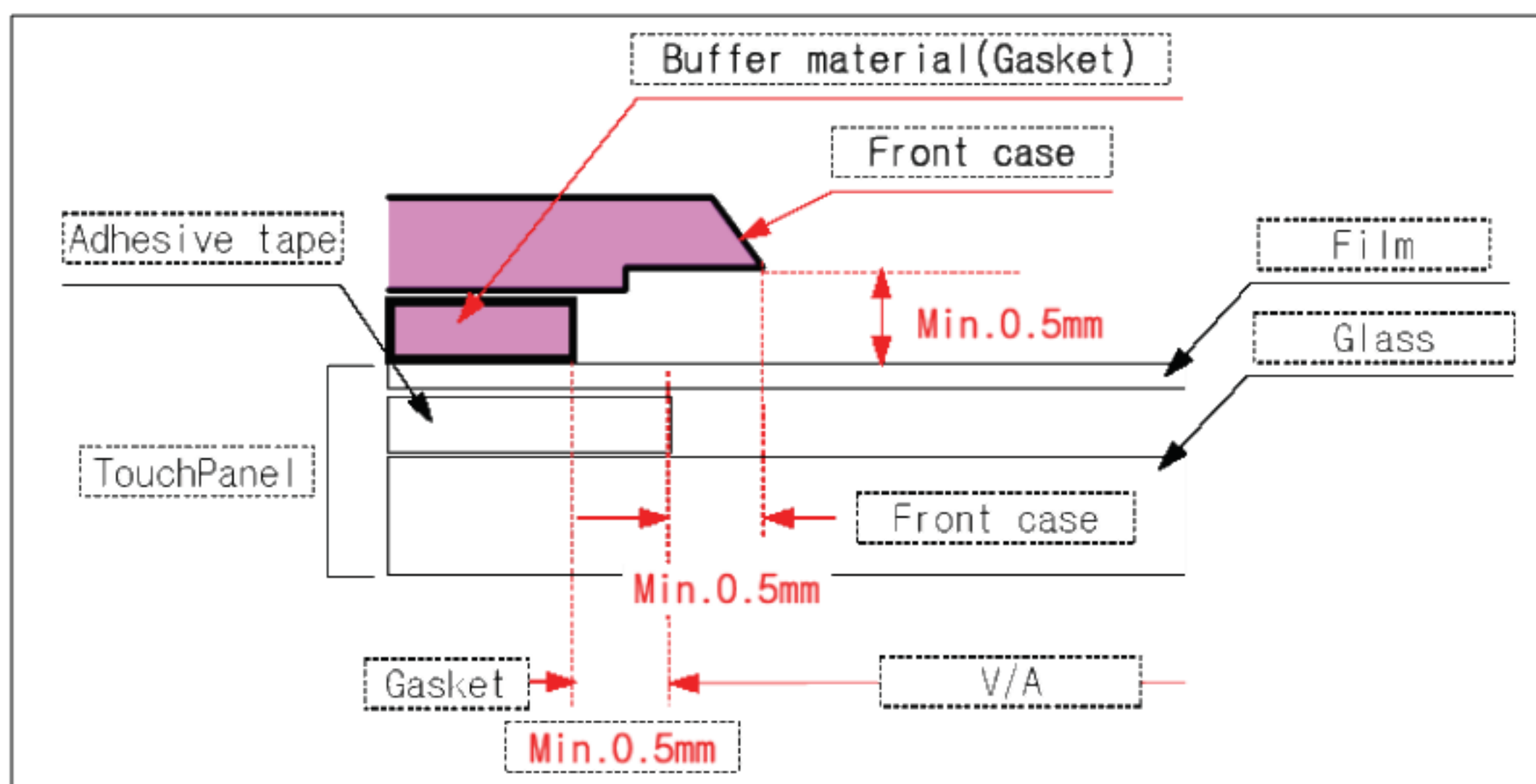
- Force : 250gf
- Speed : 2times/sec

## 4-3. Design Guide

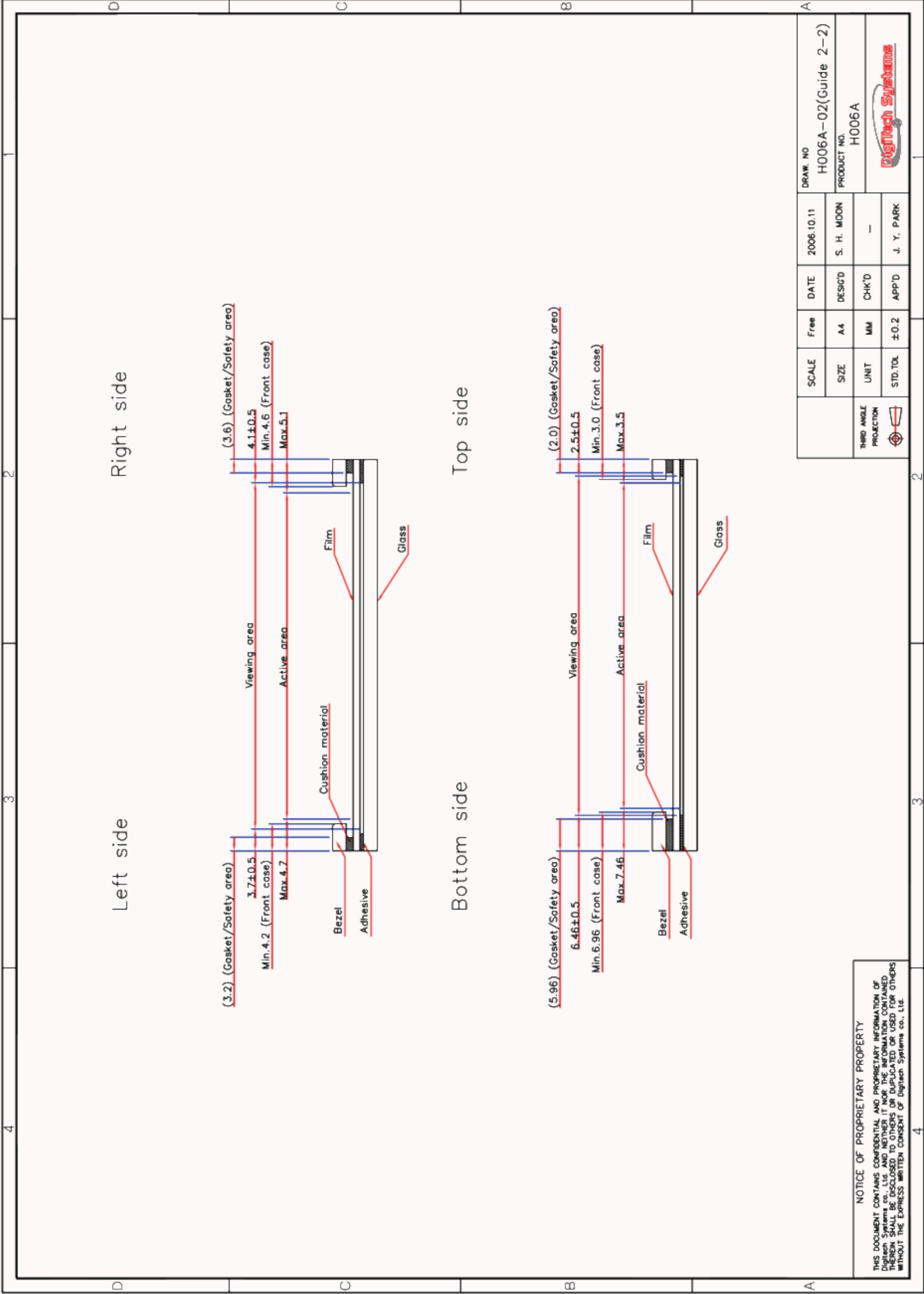
- Avoid the design that Front-case overlap and press on the active area of the touch-panel.
- Give enough gap (over 0.5mm at compressed) between the front case and touch-panel to protect wrong operating.



- Use a buffer material(Gasket) between the touch-panel and Front-case to protect damage and wrong operating.
- Avoid the design that buffer material overlap and press on the inside of touch-panel viewing area.

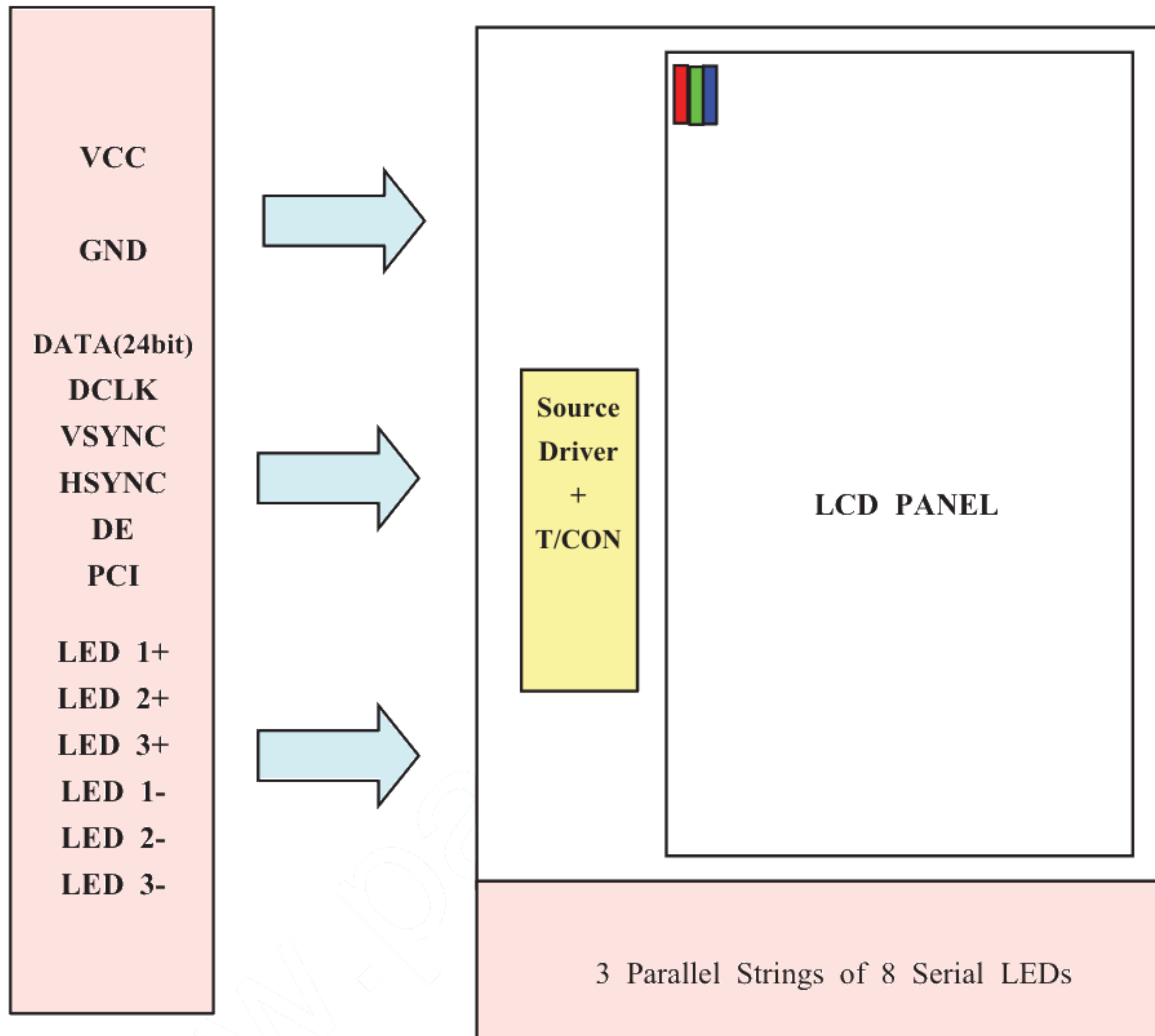




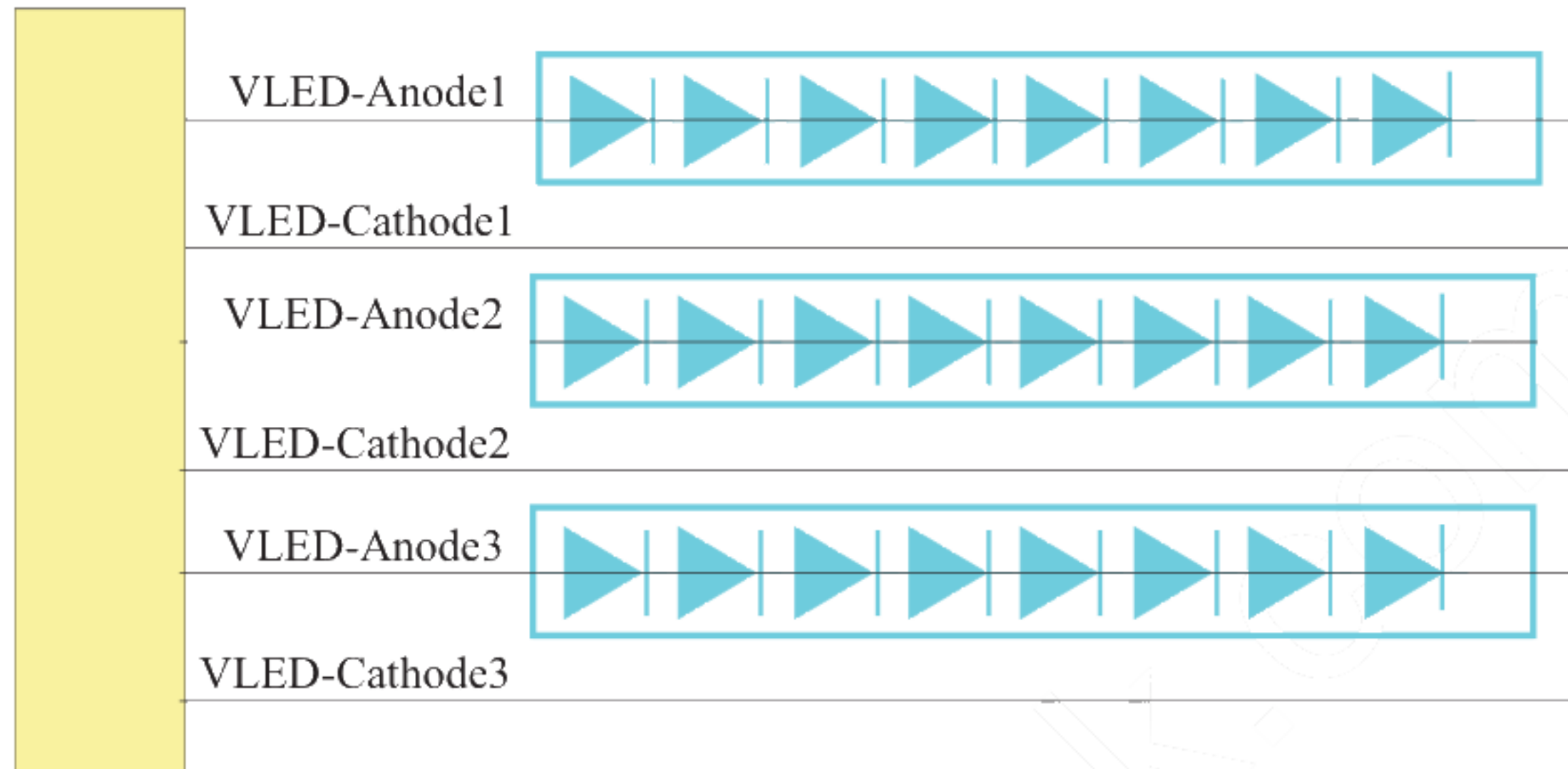


## 5. Block Diagram

### 5-1 TFT-LCD Module (Interface System Structure) with Back Light Unit



## 5-2 Back Light Unit

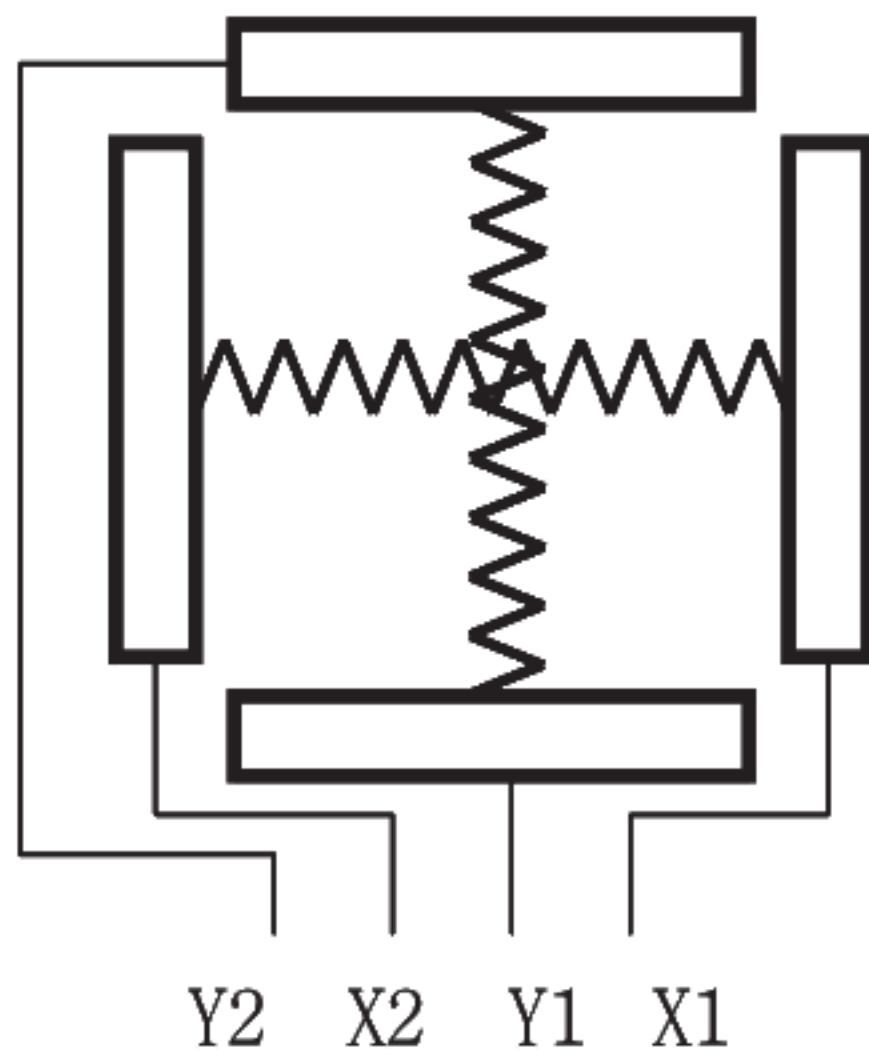


| Pin No. | Pin Description |
|---------|-----------------|
| #1      | VLED-Anode1     |
| #2      | VLED-Cathode1   |
| #3      | VLED-Anode2     |
| #4      | VLED-Cathode2   |
| #5      | VLED-Anode3     |
| #6      | VLED-Cathode3   |

\* **Note)** LED FPC Connector : 04-6298-006-000-883 (Kyocera) or compatible connector is preferred



### 5-3 Touch Panel Unit



Top View

X : Upper electrode  
Y : Lower electrode

| Pin No. | Symbol | Description |
|---------|--------|-------------|
| #1      | Y2     | TSP Top     |
| #2      | X2     | TSP Left    |
| #3      | Y1     | TSP Bottom  |
| #4      | X1     | TSP Right   |

\* **Note)** TSP FPC Connector : FH19C-4S-0.5SH (Hirose) or compatible connector is preferred



## 6. Input Terminal Pin Assignment

**6-1 Input Signal & Power** (Connector : 40Pin FPC Connector type, 0.5mm,  
ex.) Hirose connector FH28H-40S-0.5SH or compatible Connector used.)

| Pin No | Symbol          | Description          | I/O | Pin No | Symbol | Description               | I/O |
|--------|-----------------|----------------------|-----|--------|--------|---------------------------|-----|
| 1      | GND             | GND                  | I   | 21     | PD0    | Graphic Data 0 (B0)       | I   |
| 2      | GND             | GND                  | I   | 22     | PD1    | Graphic Data 1 (B1)       | I   |
| 3      | V <sub>cc</sub> | System Power Supply  | I   | 23     | PD2    | Graphic Data 2 (B2)       | I   |
| 4      | V <sub>cc</sub> | System Power Supply  | I   | 24     | PD3    | Graphic Data 3 (B3)       | I   |
| 5      | PD16            | Graphic Data 16 (R0) | I   | 25     | PD4    | Graphic Data 4 (B4)       | I   |
| 6      | PD17            | Graphic Data 17 (R1) | I   | 26     | PD5    | Graphic Data 5 (B5)       | I   |
| 7      | PD18            | Graphic Data 18 (R2) | I   | 27     | PD6    | Graphic Data 6 (B6)       | I   |
| 8      | PD19            | Graphic Data 19 (R3) | I   | 28     | PD7    | Graphic Data 7 (B7)       | I   |
| 9      | PD20            | Graphic Data 20 (R4) | I   | 29     | GND    | GND                       | I   |
| 10     | PD21            | Graphic Data 21 (R5) | I   | 30     | DOTCLK | DOT CLOCK                 | I   |
| 11     | PD22            | Graphic Data 22 (R6) | I   | 31     | PCI    | Display Mode <b>*Note</b> | I   |
| 12     | PD23            | Graphic Data 23 (R7) | I   | 32     | HSYNC  | HSYNC                     | I   |
| 13     | PD8             | Graphic Data 8 (G0)  | I   | 33     | VSYNC  | VSYNC                     | I   |
| 14     | PD9             | Graphic Data 9 (G1)  | I   | 34     | DE     | Data Enabling Signal      | I   |
| 15     | PD10            | Graphic Data 10 (G2) | I   | 35     | NC     | No Connect                | -   |
| 16     | PD11            | Graphic Data 11 (G3) | I   | 36     | NC     | No Connect                | -   |
| 17     | PD12            | Graphic Data 12 (G4) | I   | 37     | GND    | GND                       | I   |
| 18     | PD13            | Graphic Data 13 (G5) | I   | 38     | GND    | GND                       | I   |
| 19     | PD14            | Graphic Data 14 (G6) | I   | 39     | NC     | No Connect                | -   |
| 20     | PD15            | Graphic Data 15 (G7) | I   | 40     | NC     | No Connect                | -   |

**\* Note** : Regarding to the PCI, Please refer to the Power up/down sequence

## 6-2 Input Signal, Basic Display Colors and Gray Scale of Each Colors

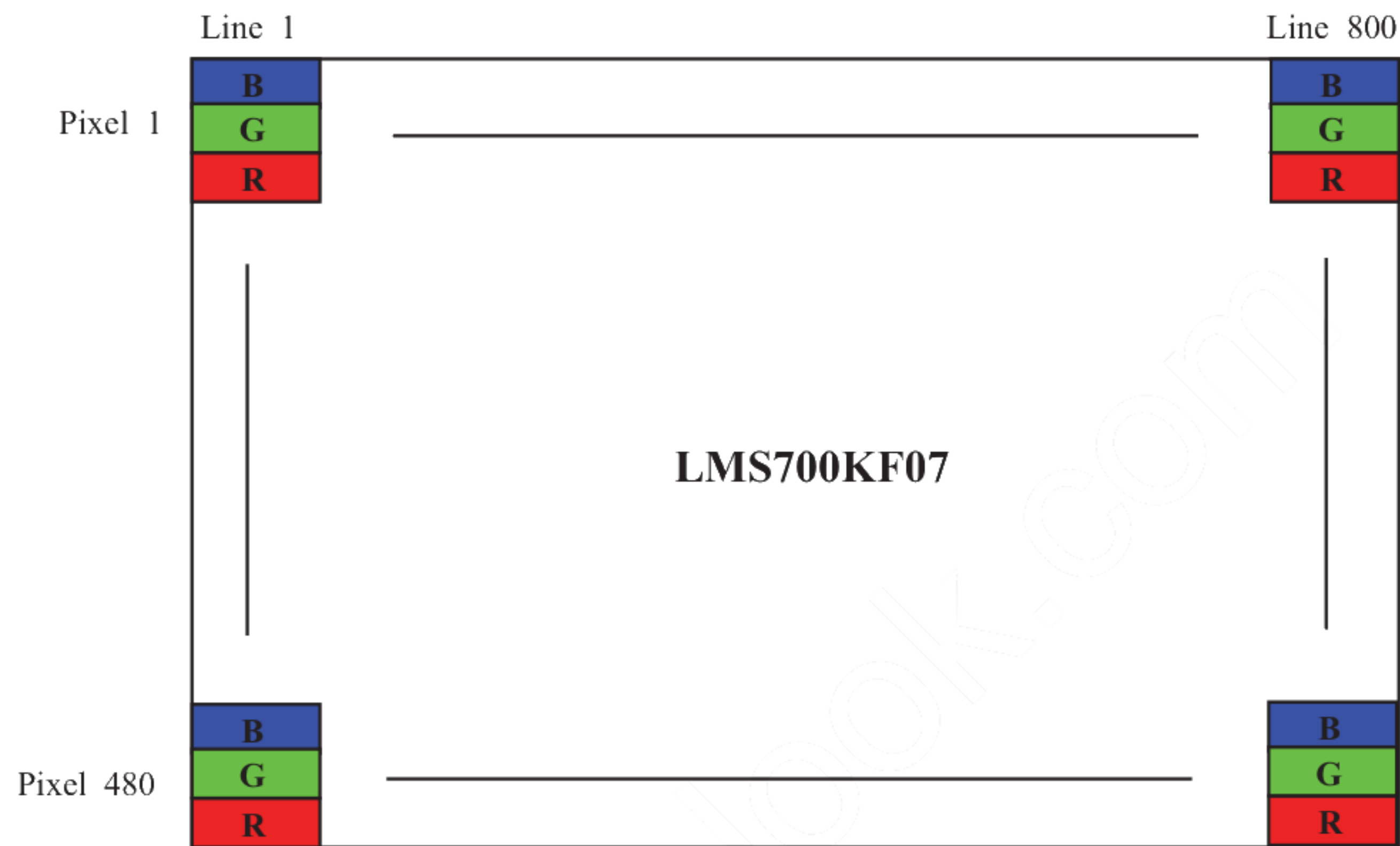
| COLOR                        | DISPLAY                     | DATA SIGNAL |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |      |    |    |    |    |    |    |    | GRAY<br>SCALE<br>LEVEL |
|------------------------------|-----------------------------|-------------|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|------|----|----|----|----|----|----|----|------------------------|
|                              |                             | RED         |    |    |    |    |    |    |    | GREEN |    |    |    |    |    |    |    | BLUE |    |    |    |    |    |    |    |                        |
|                              |                             | R0          | R1 | R2 | R3 | R4 | R5 | R6 | R7 | G0    | G1 | G2 | G3 | G4 | G5 | G6 | G7 | B0   | B1 | B2 | B3 | B4 | B5 | B6 | B7 |                        |
| BASIC<br>COLOR               | BLACK                       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | -                      |
|                              | BLUE                        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | -                      |
|                              | GREEN                       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | -                      |
|                              | CYAN                        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | -                      |
|                              | RED                         | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | -                      |
|                              | MAGENTA                     | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | -                      |
|                              | YELLOW                      | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | -                      |
|                              | WHITE                       | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | -                      |
| GRAY<br>SCALE<br>OF<br>RED   | BLACK                       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | R0                     |
|                              | DARK<br>↑<br><br>↓<br>LIGHT | 1           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | R1                     |
|                              |                             | 0           | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | R2                     |
|                              |                             | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  | R3~R252                |
|                              |                             | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  |    |                        |
|                              |                             | 1           | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | R253                   |
|                              |                             | 0           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | R254                   |
|                              | RED                         | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | R255                   |
| GRAY<br>SCALE<br>OF<br>GREEN | BLACK                       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | G0                     |
|                              | DARK<br>↑<br><br>↓<br>LIGHT | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | G1                     |
|                              |                             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 1  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | G2                     |
|                              |                             | :           |    |    | :  | :  | :  | :  | :  | :     |    |    | :  | :  | :  | :  | :  | :    |    |    | :  | :  | :  | :  | :  | G3~G252                |
|                              |                             | :           |    |    | :  | :  | :  | :  | :  | :     |    |    | :  | :  | :  | :  | :  | :    |    |    | :  | :  | :  | :  | :  |                        |
|                              |                             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 0  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | G253                   |
|                              |                             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | G254                   |
|                              | GREEN                       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | G255                   |
| GRAY<br>SCALE<br>OF<br>BLUE  | BLACK                       | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | B0                     |
|                              | DARK<br>↑<br><br>↓<br>LIGHT | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 0  | 0  | 0  | 0  | 0  | 0  | 0  | B1                     |
|                              |                             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 1  | 0  | 0  | 0  | 0  | 0  | 0  | B2                     |
|                              |                             | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  | :  | B3~B252                |
|                              |                             | :           | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  | :  |    |                        |
|                              |                             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 0  | 1  | 1  | 1  | 1  | 1  | 1  | B253                   |
|                              |                             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | B254                   |
|                              | BLUE                        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  | 1  | 1  | B255                   |

Note) Definition of Gray :

Rn : Red Gray, Gn : Green Gray, Bn : Blue Gray (n = Gray level)

Input Signal : 0 = Low level voltage, 1 = High level voltage

6-3 Pixel Format





## 7. INTERFACE TIMING

### 7-1. Vertical timing

| Signal               | Symbol           | Min. | Typ. | Max. | Unit | Note  |
|----------------------|------------------|------|------|------|------|-------|
| Frame Frequency      | f <sub>FRM</sub> | -    | 60   | -    | Hz   |       |
| Vertical Back porch  | VBP              | -    | 8    | -    | H    | *Note |
| Vertical Front porch | VFP              | -    | 5    | -    | H    | *Note |

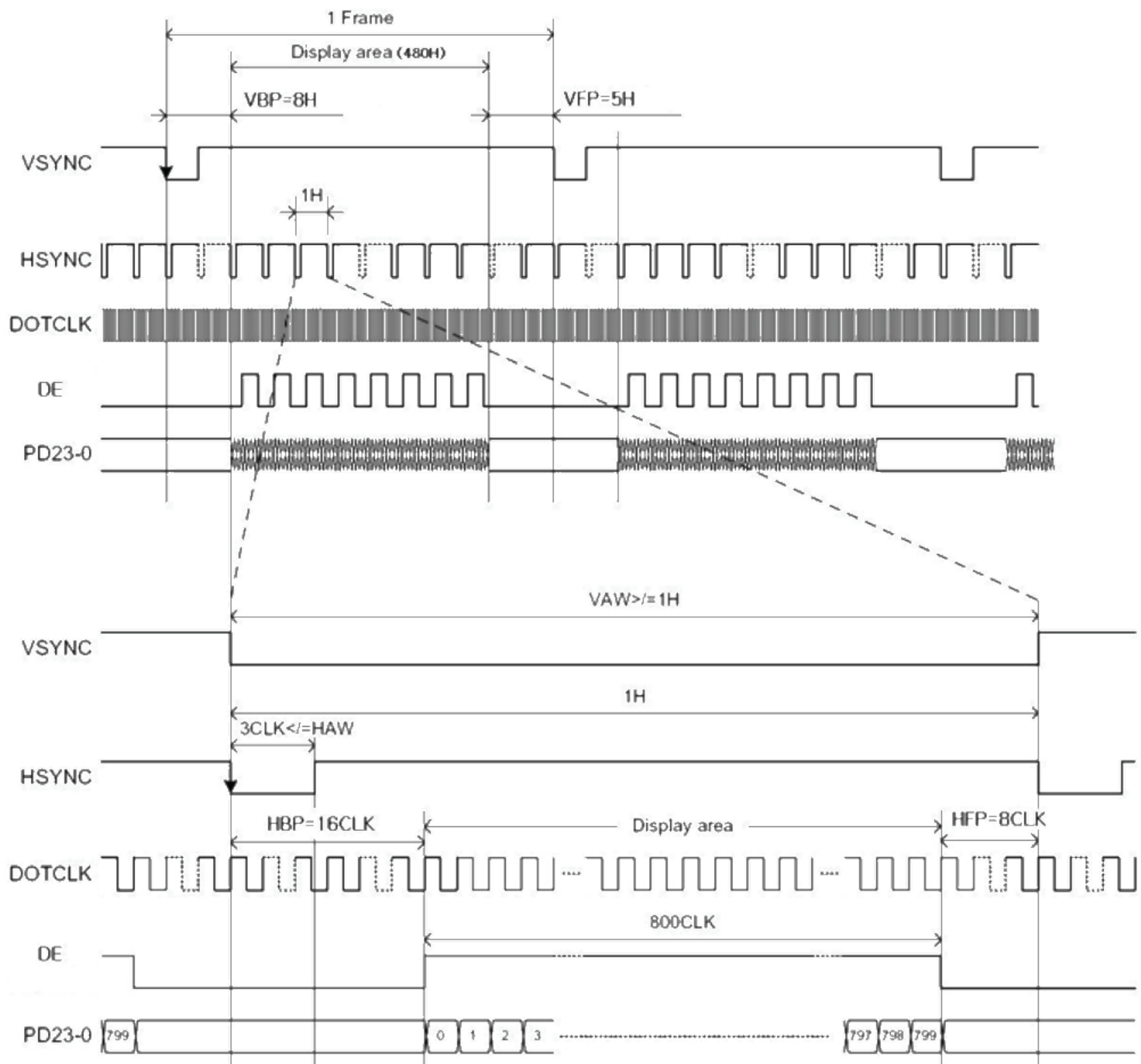
### 7-2. Horizontal timing

| Signal                 | Symbol              | Min. | Typ. | Max. | Unit   | Note                    |
|------------------------|---------------------|------|------|------|--------|-------------------------|
| Horizontal Back porch  | HBP                 | -    | 16   | -    | DOTCLK | *Note                   |
| Horizontal Front porch | HFP                 | -    | 8    | -    | DOTCLK | *Note                   |
| DOTCLK Frequency       | f <sub>DOTCLK</sub> | -    | 24.5 | -    | MHz    | @f <sub>FRM</sub> =60Hz |

\*Note). VBP, VFP, HBP, HFP are fixed, set those timing data as the above data.



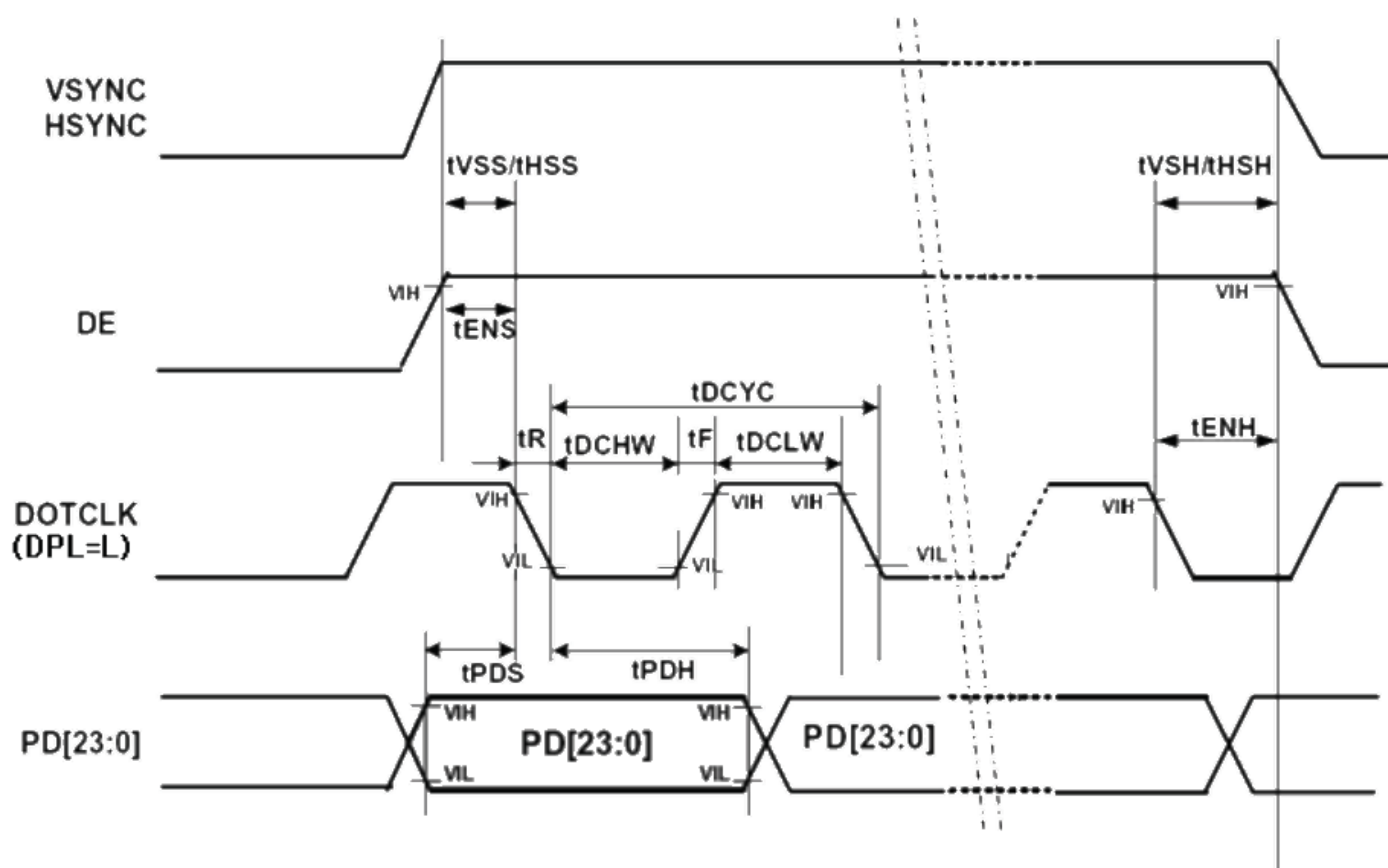
### 7-3 Interface Timing



## 7-4 AC Characteristic

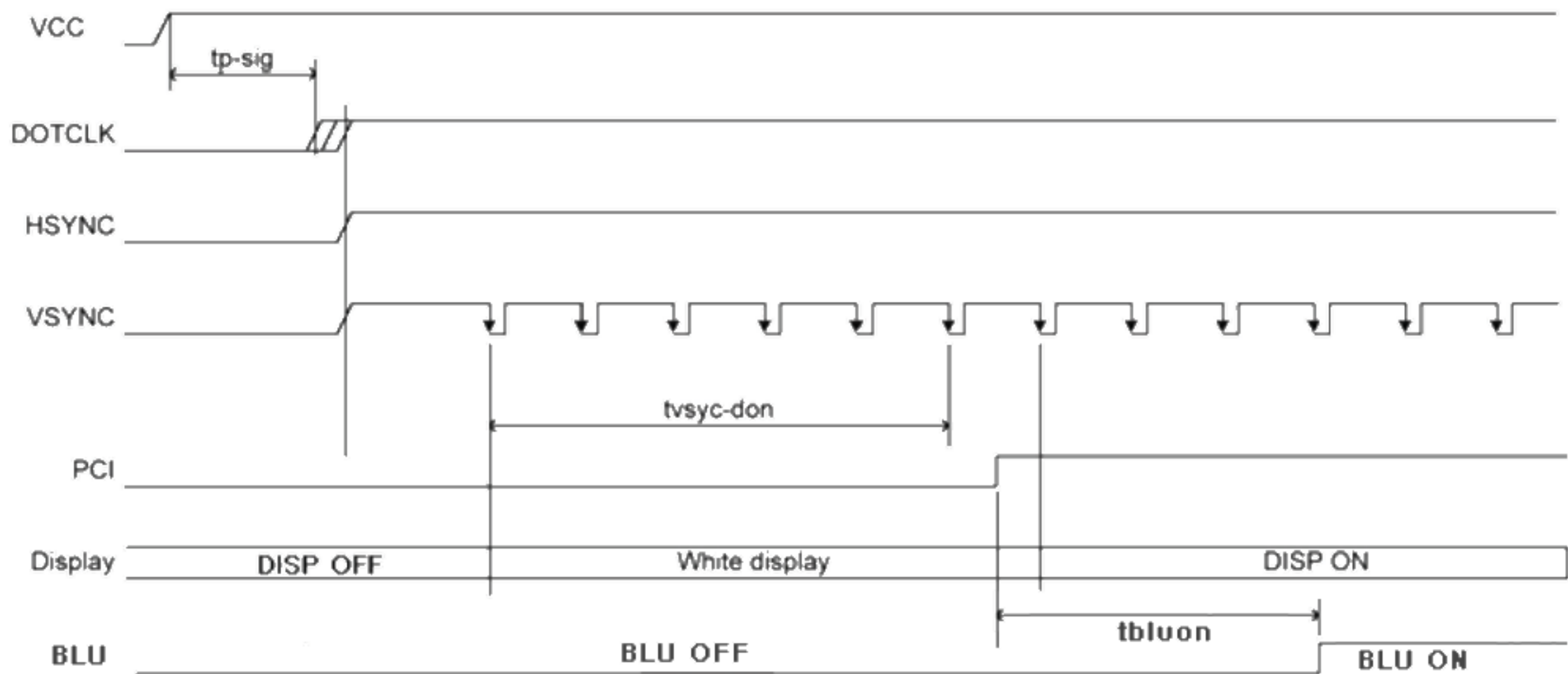
(Ta=-40 to +85 °C, 24bit interface)

| Parameter               | Symbol | Min. | Typ. | Max. | Unit |
|-------------------------|--------|------|------|------|------|
| VSYNC setup time        | tVSS   | 5    | -    | -    | ns   |
| VSYNC hold time         | tVSH   | 5    | -    | -    |      |
| HSYNC setup time        | tHSS   | 5    | -    | -    |      |
| HSYNC hold time         | tHSH   | 5    | -    | -    |      |
| DOTCLK cycle time       | tDCYC  | 28   | -    | -    |      |
| DOTCLK rise/fall time   | tR,tF  |      | -    | 2    |      |
| DOTCLK Pulse width high | tDCHW  | 8    | -    | -    |      |
| DOTCLK Pulse width low  | tDCLW  | 8    | -    | -    |      |
| DE setup time           | tENS   | 5    | -    | -    |      |
| DE hold time            | tENH   | 5    | -    | -    |      |
| PD data setup time      | tPDS   | 5    | -    | -    |      |
| PD data hold time       | tPDH   | 5    | -    | -    |      |



## 8. Power Up/Down sequence

### 8-1 Power up sequence.

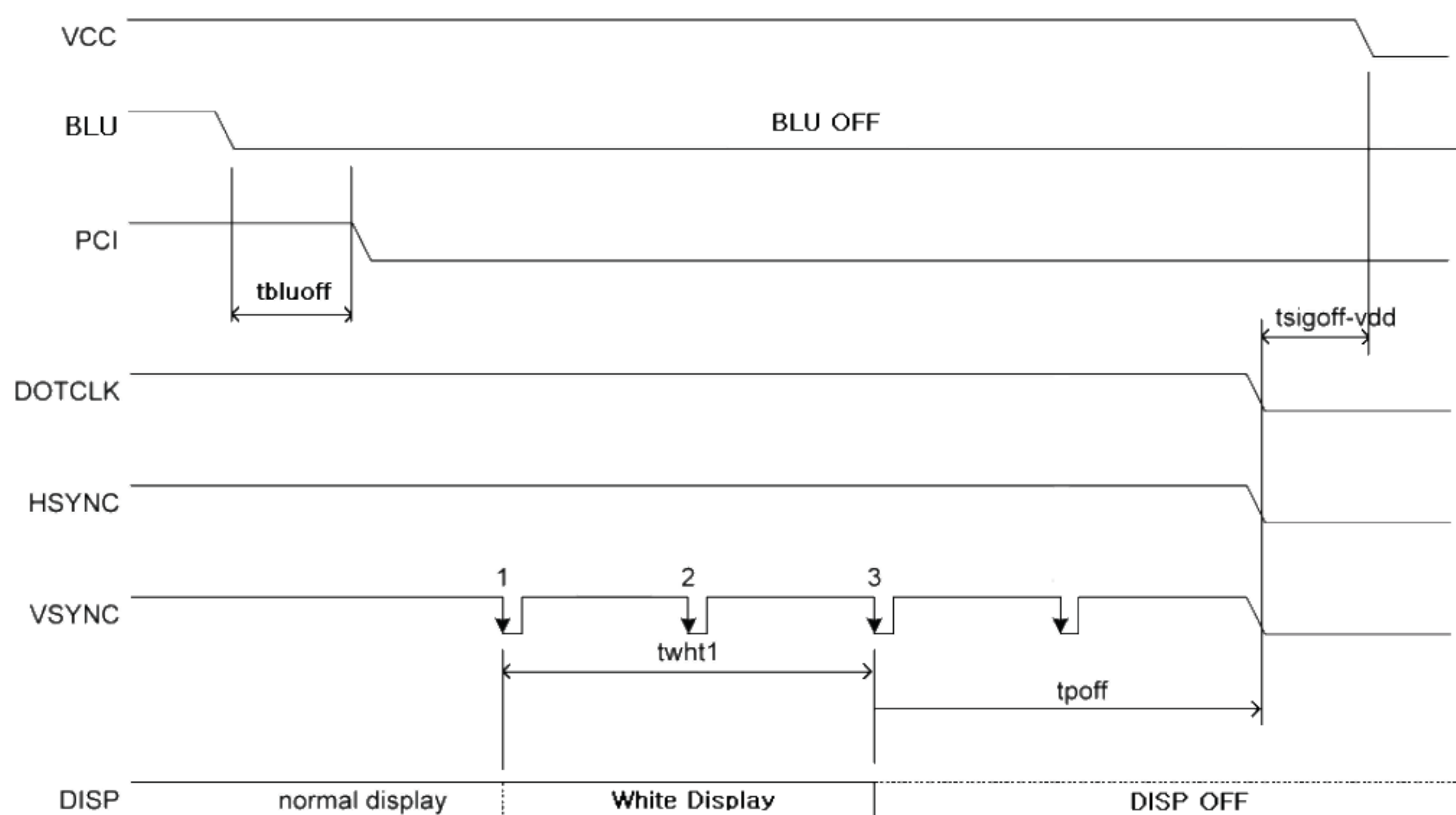


| Characteristics                                 |                 | MIN  | TYP | MAX | Unit  |
|-------------------------------------------------|-----------------|------|-----|-----|-------|
| VCC on to Signal input                          | $t_{p-sig}$     | 10   |     |     | mS    |
| Waiting time to DISP ON from 1st VSYNC          | $t_{vsync-don}$ | 16.7 |     |     | mS    |
|                                                 |                 | 1    |     |     | Frame |
| BLU On Time (Duration time after PCI gets high) | $t_{bluon}$     | 50   |     |     | mS    |

Note) From the 1st Vsync after PCI set high, it starts display on.



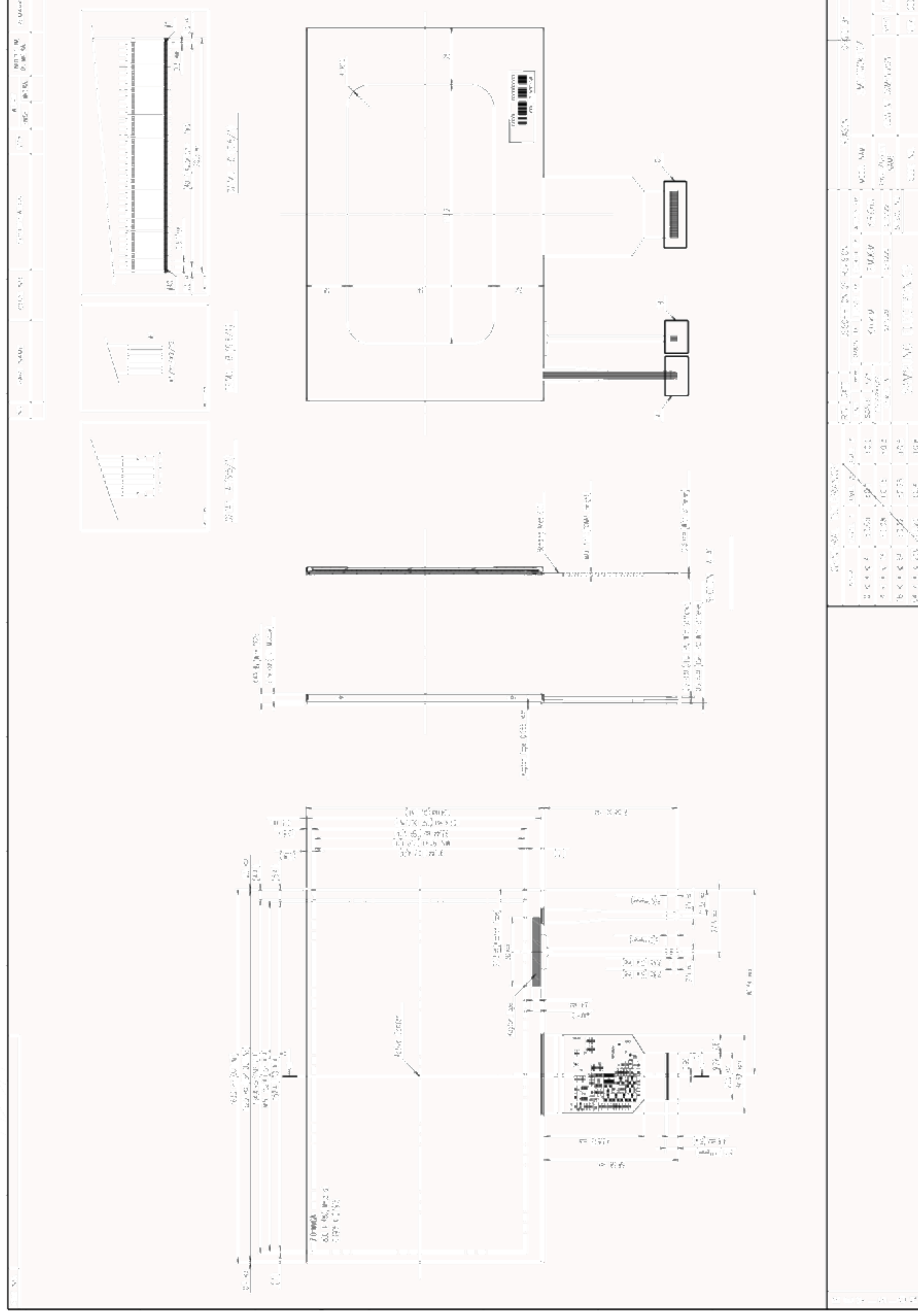
## 8.2 Power down sequence.



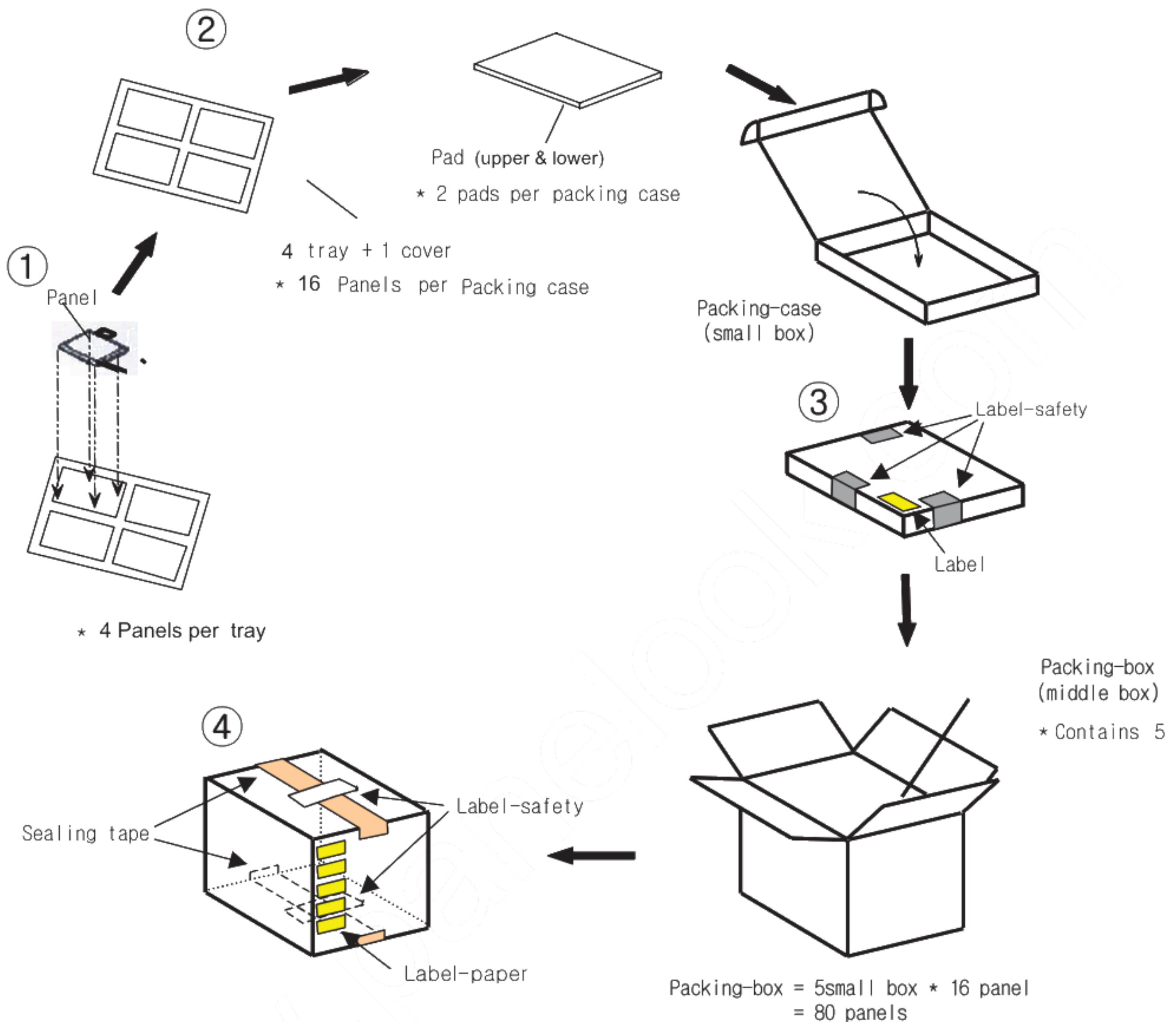
| Characteristics                                  |                  | MIN       | TYP | MAX | Unit        |
|--------------------------------------------------|------------------|-----------|-----|-----|-------------|
| BLU Off Time (Duration time before PCI gets low) | $t_{bluoff}$     | 50        |     |     | mS          |
| White Display Time (from 1st Vsync at PCI=L)     | $twht1$          | 33.3<br>2 |     |     | mS<br>Frame |
| DISP OFF Time (from 3rd Vsync at PCI=L)          | $tpoff$          | 16.7<br>1 |     |     | mS<br>Frame |
| Input-signal off to VCC Off                      | $t_{sigoff-vdd}$ | 10        |     |     | mS          |



## 9. Outline Dimension



## 10. Packing



Note (1) Total : Case: Approx. 3.1 Kg

Box: Approx. 16.2 Kg

(2) Size : Case: 490(W) x 342(D) x 58(H)

Box: 505(W) x 355(D) x 312(H)

(3) Place the panels in the tray facing the direction shown in the figure.

(4) Place 4 tray and cover(empty tray) and pads inside the packing-case.

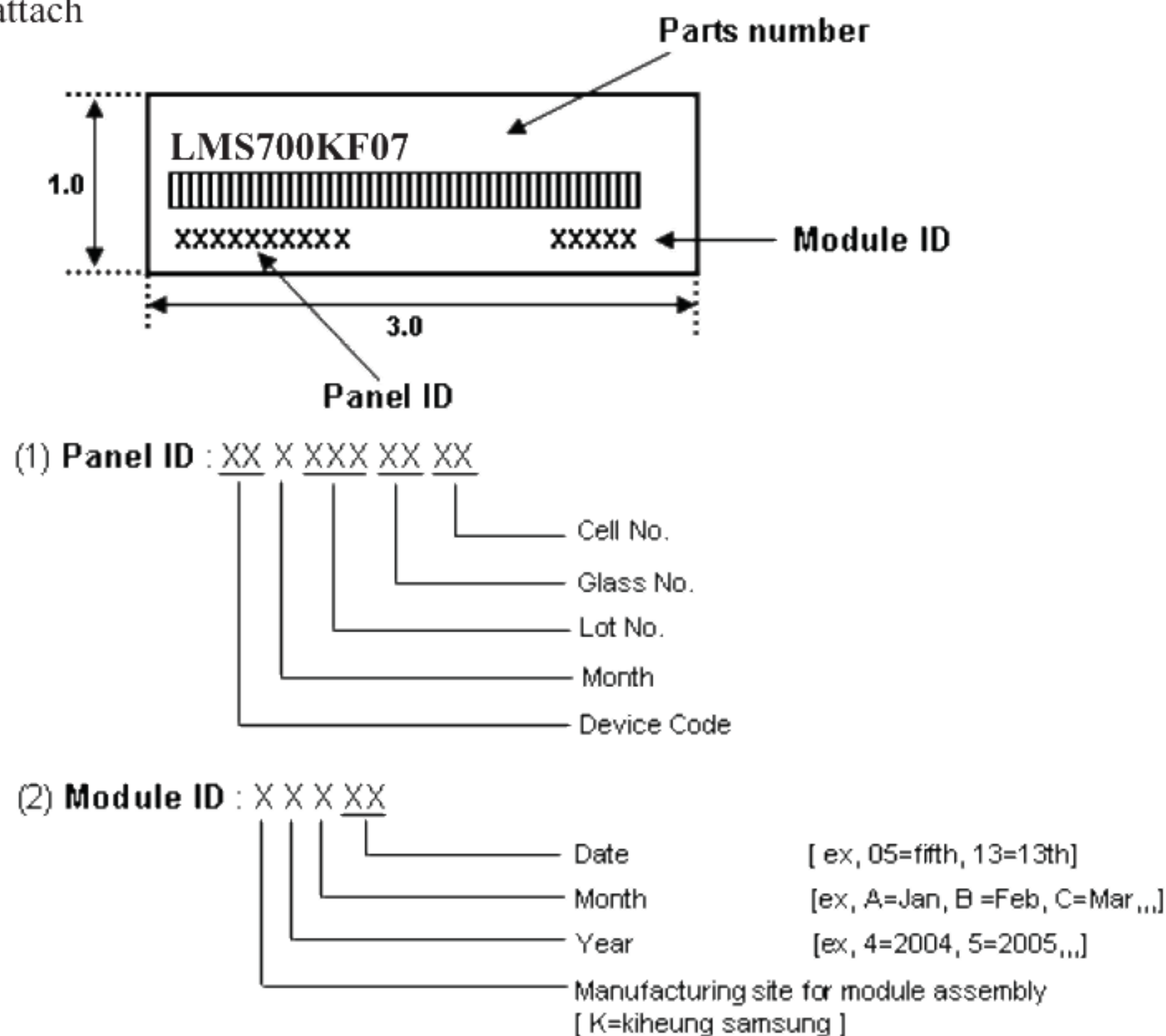
(5) Place 5 packing-case inside the packing-box.(Affix the label)

(6) Seal the packing-box. Affix the label-safety.

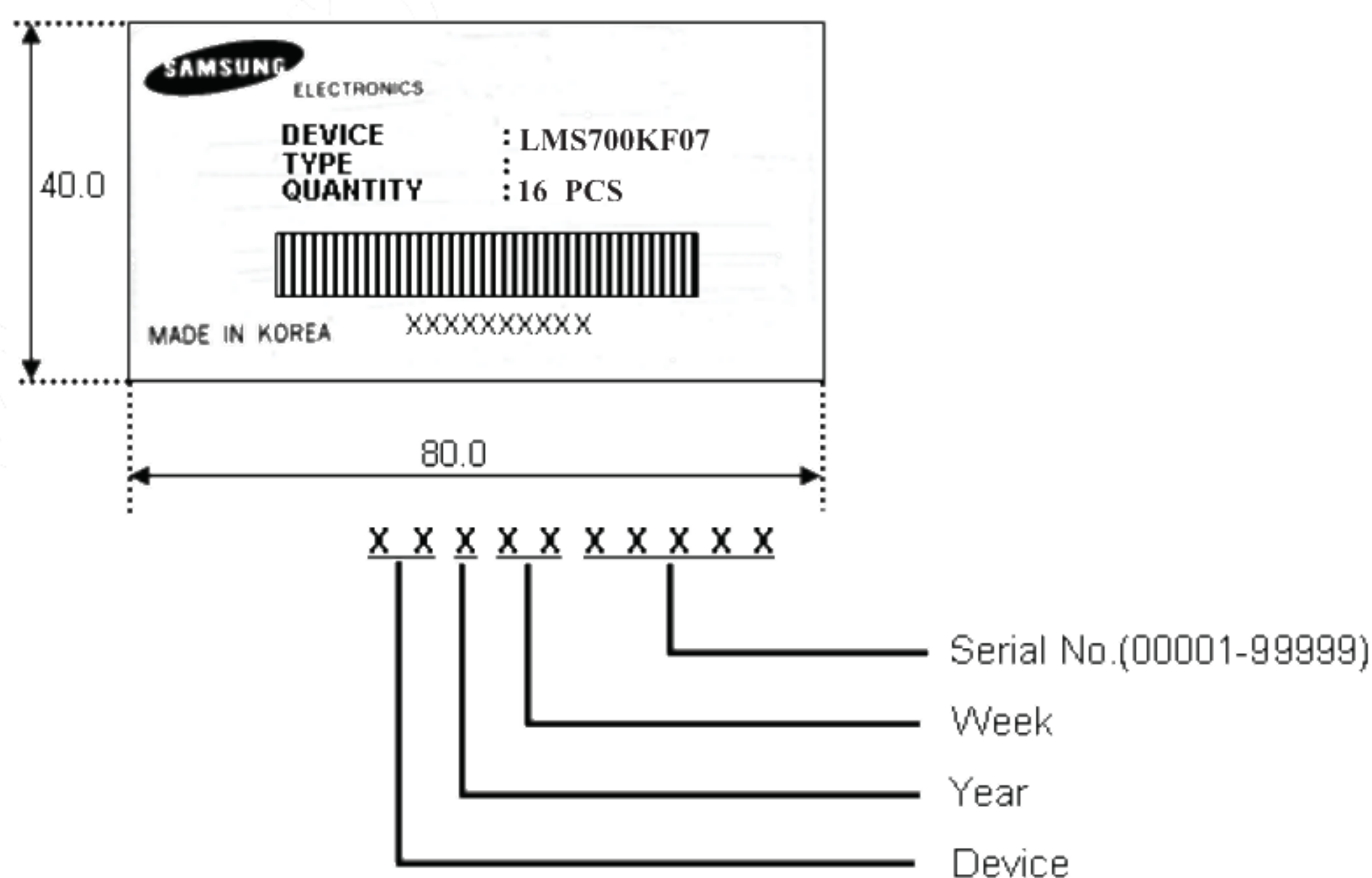
## 11. Marking & Others

A nameplate bearing followed by is affixed to a shipped product at the Specified location on each product.

### (1) Module attach



### (2) Packing Case attach





## 12. General Precautions

### 12.1 Handling

- (a) When the module is assembled, it should be attached to the system firmly. Be careful not to twist and bend the module.
- (b) Refrain from strong mechanical shock and / or any force to the module. In addition to damage, this may cause improper operation or damage to the module and back-light unit.
- (c) Note that polarizers are very fragile and could be easily damaged. Do not press or scratch the surface harder than a HB pencil lead.
- (d) Wipe off water droplets or oil immediately. If you leave the droplets for a long time, Staining and discoloration may occur.
- (e) If the surface of the polarizer is dirty, clean it using some absorbent cotton or soft cloth.
- (f) The desirable cleaners are water, IPA(Isopropyl Alcohol) or Hexane. Do not use Ketone type materials(ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanent damage to the polarizer due to chemical reaction.
- (g) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, legs or clothes, it must be washed away thoroughly with soap.
- (h) Protect the module from static , it may cause damage to the Integrated Gate Circuit.
- (i) Use finger-stalls with soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (j) Do not disassemble the module.
- (k) Protection film for polarizer on the module shall be slowly peeled off just before use so that the electrostatic charge can be minimized.
- (l) Pins of I/F connector shall not be touched directly with bare hands



## 12.2 Storage

- (a) Do not leave the panel in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35°C and relative humidity of less than 70%.
- (b) Do not store the TFT-LCD module in direct sunlight.
- (c) The module shall be stored in a dark place. It is prohibited to apply sunlight or fluorescent light during the store.

## 12.3 Operation

- (a) Do not connect, disconnect the module in the "Power On" condition.
- (b) Power supply should always be turned on/off by the "Power on/off sequence"

## 12.4 Others

- (a) The Liquid crystal is deteriorated by ultraviolet, do not leave it in direct sunlight and strong ultraviolet ray for many hours.
- (b) Avoid condensation of water. It may result in improper operation or disconnection of electrode.
- (c) Do not exceed the absolute maximum rating value. ( the supply voltage variation, input voltage variation, variation in part contents and environmental temperature, and so on) Otherwise the panel may be damaged.
- (d) If the panel displays the same pattern continuously for a long period of time, it can be the situation when the image "Sticks" to the screen.
- (e) This panel has its circuitry FPC on the bottom side and should be handled carefully in order not to be stressed.